INTERIM REMEDIAL ACTION RECORD OF DECISION

DECLARATION

SITE NAME AND LOCATION

U.S. Department of Energy 100 Area
100-NR-1 Operable Unit
Hanford Site
Benton County, Washington

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial actions for a portion of the U.S. Department of Energy's (DOE) 100 Area, Hanford Site, Benton County, Washington. These actions were chosen in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended by the *Superfund Amendments and Reauthorization Act of 1986*, and to the extent practicable, the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP). Specifically, the selected remedial actions will address contaminated soils, structures, and pipelines associated with two *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal (TSD) units and an associated site. These TSD units and associated sites are located next to the Columbia River in the 100-NR-1 Operable Unit (OU) at the Hanford Site near Richland, Washington. The 100-NR-1 OU is within the Hanford Site's 100 Area, which is a National Priorities List site. The decisions documented in this Interim Remedial Action Record of Decision (ROD) are based on the Administrative Record for the Hanford Site and for the 100-NR-1 OU.

The State of Washington, acting through and by the Washington State Department of Ecology (Ecology), concurs with the remedy selected in this document.

Assessment of the Site

Two TSD units, the 116-N-1 and 116-N-3 Cribs and Trenches, and the associated site, UPR-100-N-31 Unplanned Release, contain radioactively and chemically contaminated soils, structures, and/or pipelines. Actual or threatened releases of hazardous substances from the waste sites, if not addressed by implementing the response actions selected in this interim remedial action, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

INTEGRATION OF CERCLA AND RCRA REQUIREMENTS

This ROD is being used to document decisions for sites that are defined under the *Hanford Federal Facility Agreement and Consent Order* (referred to as the Tri-Party Agreement) as

RCRA corrective action units or TSD units requiring closure. Consistent with the Tri-Party Agreement, all hazardous substances present at these sites will be addressed. By coordinating RCRA closure (Section 3005[e] of RCRA) and CERCLA remedial action, remediation of all hazardous substances, including CERCLA hazardous substances including radionuclides, can be ensured. By applying CERCLA authority jointly with that of RCRA, additional options for disposal of corrective action and remedial action wastes at the Hanford Environmental Restoration Disposal Facility (ERDF) are possible. DOE shall comply with all permit conditions stated in the Hanford Facility RCRA Permit for any site covered by this ROD, and issuance of this ROD does not effect DOE's obligation to comply with those permit conditions.

It is the intent of the Tri-Parties to select the same remedy for sites requiring RCRA corrective action and modified closure as selected for those sites requiring CERCLA interim remedial actions. The *Hanford Facility RCRA Permit* has been modified to include the two RCRA TSD units. The public has commented on the Permit conditions relevant to these actions in accordance with the Tri-Party Agreement and applicable state and federal regulations.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy is an interim remedial action for three sites within the 100-NR-1 OU. The selected remedy addresses actual or threatened releases to the environment from structures and/or pipelines at two TSD units, the 116-N-1 and 116-N-3 liquid waste disposal facilities, and the UPR-100-N-31 unplanned release site. Releases to the groundwater from these sites and releases to soils, structures, and/or pipelines from other sites within the 100-NR-1 OU are addressed in a separate ROD (Interim Remedial Action Record of Decision, 100-NR-1 and 100-NR-2 Operable Unit, September 1999). The major components of the selected remedy include the following:

<u>116-N-1 and 116-N-3 Liquid Waste Disposal Facilities, and the UPR-100-N-31 Unplanned Release Site</u>

Work required at these sites includes the following:

1. Per the Tri-Party Agreement, DOE is required to submit the remedial design report, remedial action work plan, and sampling and analysis plan as primary documents. These documents and associated documents concerning the planning and implementation of remedial design and remedial action shall be submitted to Ecology for approval prior to the initiation of remediation. The 100 Area remedial design report and remedial action work plan may be revised as an alternative to submitting new documents. All work required under this approved interim remedial action must be done in accordance with approved plans and ARARs.

2. Prior to beginning remedial action or excavation, a cultural and natural resources review will be conducted.

3. Remove and stockpile any uncontaminated overburden that needs to be moved to gain access to contaminated soils and, to the extent practicable, use this overburden for backfilling excavated areas.

4. The extent of remediation of the waste sites will be as follows:

   a) For remediation of the top 4.6 m (15 ft) below surrounding grade or the bottom of the engineering structure, whichever is deeper, remove until contaminant levels are: (1) demonstrated to be at or below MTCA Method B levels for nonradioactive chemicals, and achieve 15 mrem/year above background for radionuclides for rural residential exposure (see Table 2), and (2) demonstrated to provide protection of the groundwater and the Columbia River. Contaminant levels will be reduced so concentrations reaching the groundwater or the Columbia River do not exceed MTCA Method B levels, federal and state MCLs, or federal and state AWQC, whichever is most restrictive.

   b) For sites where the engineered structure and/or contaminated soil and debris begins above 4.6 m (15 ft) and extends to below 4.6 m (15 ft), the engineered structure (at a minimum) will be remediated to achieve RAOs such that contaminant levels are demonstrated to be at or below MTCA Method B levels for nonradioactive chemicals for exposure and the 15 mrem/yr residential dose level (see Table 2), and are at levels that provide protection of groundwater and the Columbia River. Any residual contamination present below the engineered structure and at a depth greater than 4.6 m (15 ft) shall be subject to several factors in determining the extent of remediation, including reduction in risk by decay of short-lived radionuclides (half-life less than 30.2 years), protection of human health and the environment, remediation costs, sizing of the ERDF, worker safety, presence of ecological and cultural resources, the use of institutional controls, and long-term monitoring costs. The extent of remediation also must ensure that contaminant levels remaining in the soil are at or below MCLs for protection of groundwater or AWQC for protection of the Columbia River. For radionuclides, groundwater and river protection may be demonstrated through a technical evaluation using the computer model RESRAD. The application of the criteria for the balancing factors will be made by EPA and Ecology on a site-by-site basis. A public comment period of no less than 30 days will be required prior to making any determination to invoke balancing factors.

   c) Remove soils to a depth of 1.5 m (5 ft) below the engineered structures of 116-N-1 and 116-N-3 cribs and trenches that contain plutonium-239/240.

5. The measurement of contaminant levels during remediation will rely on field screening methods. Appropriate confirmational sampling of field screen measurements will be taken to correlate and validate the field screening. After field screening activities have indicated that cleanup levels have been achieved, a more extensive confirmational sampling program will be undertaken that routinely achieves higher levels of quality assurance and quality control that will support the issuance of an interim remedy CERCLA closeout report for the waste site.

6. After a site has been demonstrated to achieve cleanup levels and remedial action objectives (RAOs), it will be backfilled and re-vegetated. To the extent practicable, removed and stockpiled uncontaminated overburden and uncontaminated debris will be used for backfilling of excavated areas. Re-vegetation plans will be developed as part of remedial design activities. Efforts will be made to avoid or minimize impacts to natural resources during remedial activities, and the Natural Resources Trustees and Native American Tribes will be consulted during mitigation and restoration activities.

7. Pipelines associated with the units will be removed and disposed or sampled to determine if they meet remedial action objectives and can be left in place.

8. Treatment of excavated soils will be conducted before disposal, as required, to meet RCRA land disposal restrictions and the ERDF waste acceptance criteria.

9. Excavated contaminated soils, structures, and pipelines will be transported to the ERDF for disposal. Excavation activities will follow all appropriate construction practices for excavation and transportation of hazardous materials and will follow as low as reasonably achievable (ALARA) practices for remediation workers. Dust suppression during excavation, transportation, and disposal will be implemented as necessary.

10. Post-remediation monitoring of the groundwater will be performed to confirm the effectiveness of remediation efforts and accuracy of modeling predictions associated with the selected remedy.

11. Institutional controls and long-term monitoring will be required for sites where wastes are left in place and preclude an unrestricted land use. Institutional controls selected as part of this remedy are designed to be consistent with the interim action nature of this ROD. Additional measures may be necessary to ensure long-term viability of institutional controls if the final remedial actions selected for the 100 Area does not allow for unrestricted land use. Any additional controls will be specified as part of the final remedy. The following institutional controls are required as part of this interim action:

a) DOE will continue to use a badging program and control access to the sites associated with this ROD for the duration of the interim action. Visitors entering any of the sites associated with this Interim Action ROD are required to be escorted at all times.

b) DOE will utilize the on-site excavation permit process to control land use (e.g., well drilling and excavation of soil) within the 100 Area OUs to prohibit any drilling or excavation except as approved by Ecology.

c) DOE will maintain existing signs prohibiting public access.

d) DOE will provide notification to Ecology upon discovery of any trespass incidents.

e) Trespass incidents will be reported to the Benton County Sheriff's Office for investigation and evaluation for possible prosecution.

f) DOE will add access restriction language to any land transfer, sale, or lease of property that the U.S. Government considers appropriate while institutional controls are compulsory, and Ecology will have to approve any access restrictions prior to transfer, sale, or lease.

g) Until final remedy selection, DOE shall not delete or terminate any institutional control requirement established in this Interim Action ROD unless Ecology have provided written concurrence on the deletion or termination and appropriate documentation has been placed in the Administrative Record.

h) DOE will evaluate the implementation and effectiveness of institutional controls for the 100-NR-1 on an annual basis. The DOE shall submit a report to Ecology by July 31 of each year summarizing the results of the evaluation for the preceding calendar year. At a minimum, the report shall contain an evaluation of whether or not the institutional control requirements continue to be met and a description of any deficiencies discovered and measures taken to correct problems.

12. Because this is an interim action and wastes will continue to be present in the 100 Area until such time as a final ROD is issued and final remediation objectives are achieved, a five (5)-year review will be required.

IMPACT OF THE REMEDIAL ACTION DECISION ON THE RCRA PERMIT

This ROD addresses sites that require corrective action under RCRA Section 3004(u) and closure under Section 3005(e) (as implemented through the *Washington Administrative Code* [WAC] 173-303-600). The Corrective Measures Study (CMS) (*100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev. 0, February 1998) contained closure plans for the RCRA TSD units, whereas the Proposed Plan[1] contained the RCRA Permit conditions. Through issuance of the CMS report and the Proposed Plan and consideration of comments from the public on these documents, the technical and public involvement elements of both RCRA and CERCLA were met. Closure and postclosure requirements have been incorporated into the RCRA Permit.

In the Proposed Plan, the Tri-Parties identified a preferred remedy for the 120-N-1 Percolation Pond, the 120-N-2 Surface Impoundment, and the 100-N-58 South Settling Pond. This remedy included removal of liners, structures, and pipelines, followed by backfilling, regrading, and revegetation of these sites. The Proposed Plan noted that sampling at these sites indicated that no soil contamination was present at these sites. As a consequence, these sites are not included in this ROD.

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[1] *Proposed Plan for Interim Remedial Action and Dangerous Waste Modified Closure of the Treatment, Storage, and Disposal Units and Associated Sites in the 100-NR-1 Operable Unit*, DOE/RL-97-30, Rev. 0, U.S. Department of Energy, Richland, Washington.

STATUTORY DETERMINATIONS

This selected interim remedial action for the 100-NR-1 waste sites is protective of human health and the environment, complies with federal and state requirements that are legally applicable, or relevant and appropriate (ARAR) for this action, and is cost effective.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Tri-Parties have determined that the selected remedy for the 100-NR-1 source OU utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Of the alternatives analyzed, the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; cost; and also considers the statutory preference for treatment as a principal element and considering state and community acceptance.

Five (5) Year Review Requirement

Because this remedy may result in hazardous substances remaining on-site above levels that allow for unlimited use, a review will be conducted to ensure that the remedies continue to provide adequate protection of human health and the environment within five (5) years after the commencement of the interim remedial actions. This is an Interim Action ROD; therefore, review of these sites and these remedies will be on-going as the Tri-Parties continue to develop final remedial measures for the 100 Area.

On-Site Determination

The preamble to the National Contingency Plan states that when non-contiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such non-contiguous facilities without having to obtain a permit. The 100 Area NPL waste sites addressed by this ROD are reasonably close to ERDF and compatible for disposal of excavated waste at ERDF. Therefore, the sites addressed by this Interim Action ROD and ERDF are considered to be a single site for the response purposes under this ROD.

Signature sheet for the Record of Decision for the DOE Hanford 100-NR-1 Operable Unit Interim Remedial Actions between the United States Department of Energy and the Washington State Department of Ecology, with concurrence by the United States Environmental Protection Agency.

Keith A. Klein
Manager, Richland Operations Office
United States Department of Energy

Date

Signature sheet for the Record of Decision for the DOE Hanford 100-NR-1 Operable Unit Interim Remedial Actions between the United States Department of Energy and the Washington State Department of Ecology, with concurrence by the United States Environmental Protection Agency.

Chuck Clarke

Chuck Clarke
Regional Administrator, Region 10
United States Environmental Protection Agency

1-18-00

Date

Signature sheet for the Record of Decision for the DOE Hanford 100-NR-1 Operable Unit Interim Remedial Actions between the United States Department of Energy and the Washington State Department of Ecology, with concurrence by the United States Environmental Protection Agency.

Michael Wilson
Program Manager, Nuclear and Mixed Waste Program
Washington State Department of Ecology

1/19/00
Date

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DECISION SUMMARY

I. SITE LOCATION AND DESCRIPTION

Location

The Hanford Site is a federal facility managed by the U.S. Department of Energy (DOE). It was established in 1943 to produce plutonium for nuclear weapons using reactors and chemical processing. The Hanford Site occupies approximately 1,517 km^2 (568 mi^2) along the Columbia River in Benton County, which is in southeastern Washington State. The Hanford Site is situated north and west of the cities of Richland, Kennewick, and Pasco, an area commonly known as the Tri-Cities (Figure 1). The Hanford Site is divided into areas based on the primary use during operation. The Site's nine plutonium production reactors were located in the 100 Area. The 100-N Area is situated in the 100 Area in the northern part of the Hanford Site on a broad strip of land along the Columbia River about 48 km (30 mi) northwest of the city of Richland, Washington. The 100-N Area has been divided into two operable units (OUs), the 100-NR-1 Source OU and the 100-NR-2 Groundwater OU. The three 100-NR-1 OU sites addressed in this Interim Remedial Action Record of Decision (ROD) includes two treatment, storage, and disposal (TSD) units and one associated site, including pipelines and structures. The two TSD units are:

- 116-N-1 (1301-N) Crib and Trench
- 116-N-3 (1325-N) Crib and Trench

The one associated site is:

- 100-N-31 Unplanned Release (UPR)

The locations of these three units within the 100-NR-1 OU are shown in Figure 1.

Demographics

The Tri-Cities constitutes the nearest population center to the 100-N Area, with an estimated population of about 111,000 in 1997. The surrounding communities of Benton City, Prosser, and West Richland were estimated to have a combined population of nearly 14,000 in 1997. Industries in the Tri-Cities are mostly related to agriculture and electric power generation.

Land Use

Land uses in the areas surrounding the Hanford Site include urban and industrial development, irrigated and dry-land farming, grazing, and designated wildlife refuges. Wheat, corn, alfalfa, hay, barley, and grapes are the major crops in Benton, Franklin, and Grant Counties. The large area within the Hanford Site boundary provides a buffer for the smaller areas currently used for

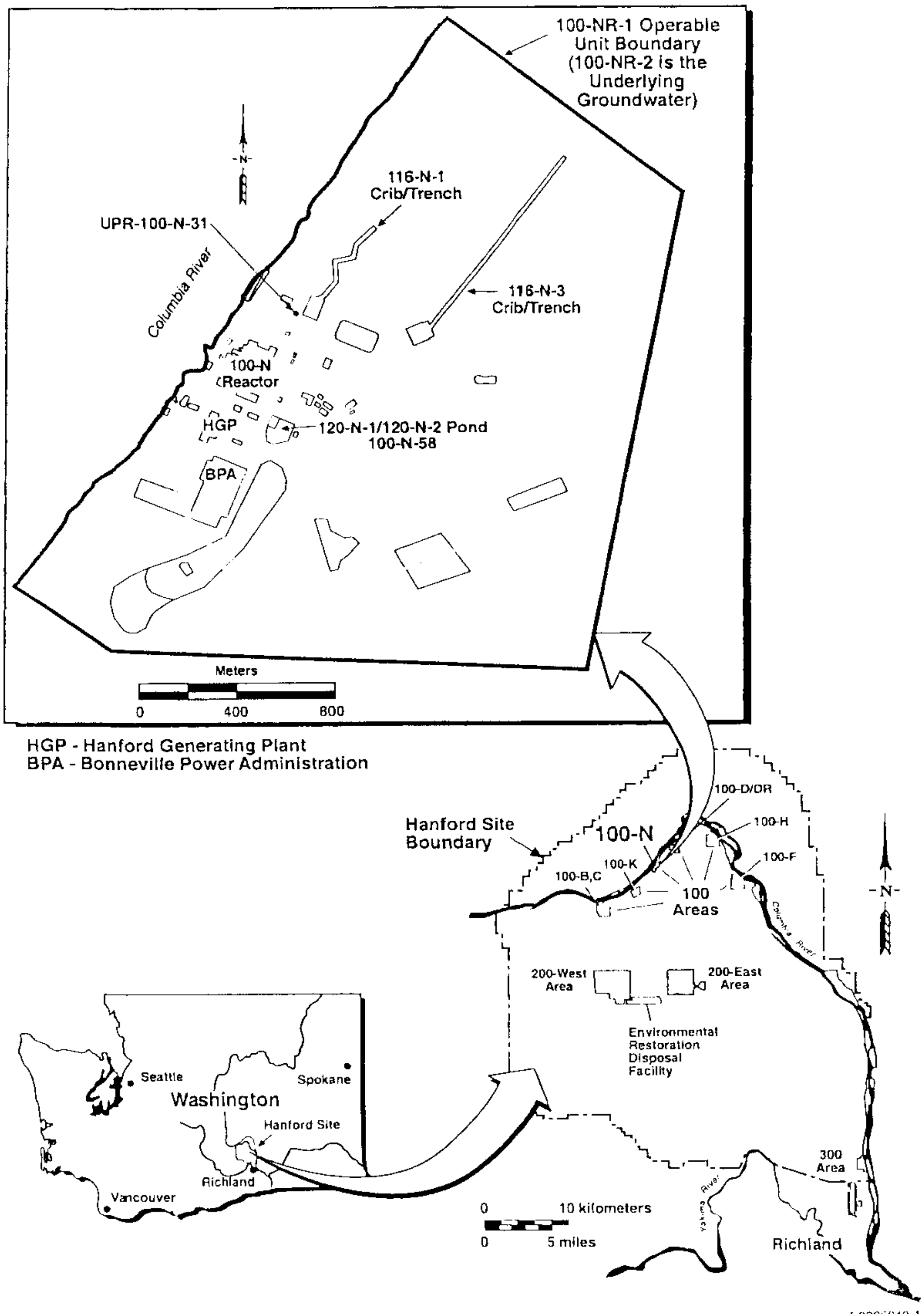

Figure 1. Location of the 100-NR-1 Operable Unit.

storage of nuclear materials, waste storage, and waste disposal. Public access to the Hanford Site, including some parts of the Columbia River, is restricted.

For more than 40 years after the federal facility was established, the primary mission at Hanford Site was the production of nuclear materials for national defense. Today, the Hanford Site has a diverse set of mission elements associated with environmental restoration, waste management, and science and technology. Future land use of the Hanford Site and surrounding areas is a topic that has undergone significant evaluation and is of interest to a variety of stakeholders, including federal, state, and tribal agencies, and the general public. Assumptions about the future land use are important in the decision-making process for determining remedial action objectives (RAOs) and establishing cleanup standards. The DOE conducted an environmental impact study to establish future land-use objectives for the Hanford Site to guide the process of remediation. As part of the scoping process for the environmental impact statement, and in attempt to foster participation by interested stakeholders, the Hanford Future Site Uses Working Group (Working Group) was established in 1992. The Working Group included representatives from labor, environmental, governmental, tribal, agricultural, economic development, and citizen-interest groups. The Working Group recommended that the 100 Area be considered for the following four future land-use options:

- Native American uses
- Limited recreation, recreation-related commercial use, and wildlife use
- B Reactor as a museum and visitor center
- Wildlife and recreational use.

The working group report was submitted to DOE as a formal scoping statement for development of DOE's *Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP-EIS). This document evaluated five "action alternatives," each of which represented federal, state, local agency, or tribe's preferred land-use alternative. Preferred land-uses for the 100 Area included varying degrees and combinations of preservation, conservation, research and development, and recreation. The final selected land-use by DOE for the 100 Areas documented in the HCP-EIS and subsequent ROD are recreation, conservation, and preservation.

Surface Water and Groundwater

The Columbia River is the second largest river in North America and is the dominant surface-water body on the Hanford Site. The existence of the Hanford Site has precluded development of this section of the river for irrigation and power. The Hanford Reach is now being considered for designation as a National Wild and Scenic River as a result of Congressional action in 1988. The uses of the Columbia River include the production of hydroelectric power, extensive irrigation in the Mid-Columbia Basin, and as a transportation corridor for barges. Several communities located on the Columbia River rely on the river as their source of drinking water. Water from the Columbia River along the Hanford Reach is also used as a source of drinking water by several Hanford Site facilities and for industrial uses. In addition, the Columbia River is used extensively for recreation, including fishing, hunting, boating, sailboarding, water-skiing, diving, and swimming.

Seepage of groundwater into the Columbia River occurs through riverbank seeps. Seeps in the 100-N Area, called N-Springs, include overland discharges as well as upwelling of groundwater into the river. Contaminants from the past 100-N Area activities may be impacting biota exposed to these seeps. Groundwater is found in both an upper unconfined aquifer system and deeper basalt-confined aquifers. The upper aquifer system has portions that are locally confined or semi-confined. Groundwater in the upper aquifer generally flows from recharge areas in the elevated region near the western boundary of the Hanford Site toward the Columbia River on the eastern and northern boundaries. Fluctuations in river stage, because of dam operations and seasonal variations, can impact the flow direction, hydraulic gradients, and groundwater levels within the upper unconfined aquifer. The approximate depth to groundwater in the vicinity of the TSD units and associated sites ranges from 117 to 119 meters[2].

A wetlands review was conducted in 1992[3] in which no significant wetlands conditions were identified. During implementation of the selected remedy, efforts will be made to prevent and minimize any impacts to the shoreline and riverline habitats. An ecological review will be completed prior to implementation of the remedial actions, and the actions will proceed only if the review confirms the findings of the 1992 wetlands review.

Large Columbia River floods have occurred in the past, but the likelihood of recurrence of large-scale flooding has been reduced by the construction of several flood control and water storage dams upstream of the Hanford Site. Major floods on the Columbia River typically result from rapid melting of the winter snowpack over a wide area augmented by above-normal precipitation. The maximum historical flood on record occurred June 7, 1894, with a peak discharge at the Hanford Site of 21,000 m^3/s. The largest recent flood took place in 1948 with an observed peak discharge of 20,000 m^3/s at the Hanford Site[4]. It should be noted that the chance of flooding is decreased greatly because of the construction of dams upstream from the Hanford Site.

The Federal Emergency Management Agency has not prepared floodplain maps for the Hanford Reach because they only prepare maps for areas that are being developed (a criterion that specifically excludes the Hanford Reach).

Evaluation of flood potential is conducted, in part, through the concept of the probable maximum flood, which is determined from the upper limit of precipitation falling on a drainage area, and other hydrologic factors, e.g., antecedent moisture conditions, snowmelt, and tributary conditions) that could result in maximum runoff. The probable maximum flood for the Columbia River below Priest Rapids Dam has been calculated at 40,000 m^3/s, and is greater than the 500-year flood. This flood would inundate parts of the portions of the 100 Area that are located adjacent to the Columbia River; the central portion of the Hanford Site would remain unaffected[5].

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[2] This is the average elevation above mean sea level for calendar year 1998.

[3] DOE, 1992, Memorandum, J. D. Wagoner (DOE-RL), to C. M. Borgstrom (DOE), "National Environmental Policy Act (NEPA) Categorical Exclusion (CX) Determination: RCRA and CERCLA Characterization and Remediation 100 and 600 Area, Hanford Site, Richland, Washington, "CCN 9205267, dated July 23, 1992.

[4] Cushing, 1995, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNNL-6415, Rev. 7, Pacific Northwest National Laboratory, Richland, Washington.

[5] See footnote No. 4.

The U. S. Army Corps of Engineers has derived the Standard Project Flood with both dam-regulated and -unregulated peak discharges given for the Columbia River below Priest Rapids Dam[6]. The regulated Standard Project Flood for this part of the river is given as 15,200 m^3/s, and the 100-year regulated flood as 12,400 m^3/s.

Cultural Resources

The Hanford Reach is one of the most cultural resource-rich areas in the western Columbia Plateau. Pre-Hanford uses of the area included agriculture and use by Native American tribes. Archaeological evidence demonstrates the importance of this area to Native American tribes, whose presence can be traced for more than 10,000 years. The near-shore areas of the rivers (i.e., Columbia, Snake, and Yakima) contained many village sites, fishing and fish processing sites, hunting areas, plant-gathering areas, and religious sites. Upland areas were used for hunting, plant gathering, religious practices, and overland transportation.

Biota

Bisected by the last undammed stretch of the Columbia River above the tidal zone, semi-arid land with a sparse covering of cold desert shrubs and drought-resistant grasses dominates the Hanford landscape. Only about 6% of the Hanford Site has been disturbed and is actually used. The disturbed areas are surrounded by large areas of pristine shrub-steppe habitat. Several endangered and threatened plant species are found on and around the Hanford Site. The waste sites identified in the 100-NR-1 OU are within the disturbed portions of the Hanford Site. Invasive or non-native plant species have replaced many native plant species in these areas. Predominant species of wildlife in the area include mule deer, coyote, deer mice, Great Basin Pocket mice, California quail, ring-necked pheasant, black-billed magpie, and various species of raptors. The Hanford Site is located in the Pacific Flyway, and the Hanford Reach serves as a resting area for migratory waterfowl and shorebirds. The bald eagle is a regular winter resident in the area. Forty-four species of fish reside in the Hanford Reach of the Columbia River, including Chinook salmon and steelhead trout.

The Hanford Reach supports a large and diverse community of plankton, benthic invertebrates (including insect larvae, limpets, snails, sponges, and crayfish), 44 species, and other communities. Of the fish community the Chinook salmon, sockeye salmon, coho salmon, and steelhead trout use the river as a migration route to and from upstream spawning areas and are of the greatest economic importance. Table 1 provides the current list of threatened or endangered species occurring or potentially occurring on the Hanford Site.

Climate

The Hanford Site and surrounding area are located in a semi-arid region of the Columbia Basin. The Cascade Mountains to the west greatly influence the dry, hot climate of the area by creating a "rain shadow" effect. Forty percent of the area's average annual rainfall (6.25 in.) occurs between November and January. Ranges of daily maximum temperatures vary from a normal

[6] See footnote No. 4.

Table 1. Federally or Washington State Listed Threatened (T) and Endangered (E) Species Occurring or Potentially Occurring on the Hanford Site.

Common Name	Scientific Name	Federal	State
Plants			
Columbia milk-vetch	*Astragalus columbianus*		T
Columbia yellowcress	*Rorippa columbiae*		E
Dwarf evening primrose	*Oenothera pygmaea*		T
Hoover's desert parsley	*Lomatium tuberosum*		T
Loeflingia	*Loeflingia squarrosa* var. *squarrosa*		T
Northern wormwood [a]	*Artemisia camperstris borealis* var. *wormskioldii*		E
Umtanum desert buckwheat	*Eriogonum codium*		E
White Bluffs bladderpod	*Lesquerella tuplashensis*		E
White eatonella	*Eatonella nivea*		T
Birds			
Aleutian Canada goose [b]	*Branta canadensis leucopareia*	T	E
American white pelican	*Pelecanus erythrorhuchos*		E
Bald eagle	*Haliaeetus leucocephalus*	T	T
Ferruginous hawk	*Buteo regalis*		T
Peregrine falcon [b]	*Falco peregrinus*	E	E
Sandhill crane [b]	*Grus canadensis*		E
Mammals			
Pygmy rabbit [a]	*Brachylagus idahoensis*		E
Fish			
Steelhead	*Oncorhynchus mykiss*		
Upper Columbia River ESU		E	
Middle Columbia River ESU[b]		T	
Snake River Basin[b]		T	
Chinook	*Oncorhynchus tshawytscha*		
Upper Columbia River ESU		E	
Snake River Fall Run[b]		T	
Snake River Spring/Summer Run[b]		T	

(a) Likely not currently occurring on the site.
(b) Incidental occurrence.

maximum of 2°C (35°F) in late December and early January to 35°C (95°F) in late July. The Cascade Mountains also serve as a source of cold air drainage, which has a considerable effect on the wind regime of the area. Prevailing winds are from the northwest in all months of the year.

II. SITE HISTORY AND ENFORCEMENT ACTIONS

The Hanford Site was established in 1943 to produce plutonium for some of the nuclear weapons tested and used in World War II and has remained under the control of DOE or its predecessor since that time. In recent years, efforts at the Hanford Site have shifted from a national defense mission to the cleanup of contamination remaining from historical operations.

Due to discharges of dangerous waste, 100-NR-1 TSD units were placed under *Resource Conservation and Recovery Act of 1976* (RCRA) Section 3005(e) interim status by the DOE submittal of Part A, Form 3, Dangerous Waste Permit Applications. The 116-N-1 and 116-N-3 Cribs and Trenchs were placed under RCRA interim status in August 1986 and in February 1987, respectively.

In November 1989, the U.S. Environmental Protection Agency (EPA) designated the 100 Area of the Hanford Site as a Superfund site and placed it on the National Priorities List (NPL) because of soil and groundwater contamination that resulted from past operation of the nuclear facilities. To effectively address the threats associated with the NPL sites and to integrate the requirements of *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and RCRA, DOE, EPA, and the Washington State Department of Ecology (Ecology), also known as the Tri-Parties, entered into the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) in May 1989. This agreement, among other things, established a procedural framework and schedule for developing, implementing, and monitoring remedial response actions at the Hanford Site. The Tri-Party Agreement grouped more than 1,000 inactive waste disposal and unplanned release sites and contaminated groundwater source and groundwater OUs, including the 100-NR-1 and 100-NR-2 OUs, at that time. Milestones for completion of a limited field investigation (LFI) report, corrective measures studies (CMSs), and RCRA closure plans for the 100-NR-1 and 100-NR-2 OUs were established in the Tri-Party Agreement under Milestone M-15-12.

Signatories to the Tri-Party Agreement developed a coordinated CERCLA/RCRA site characterization and remediation strategy to comprehensively and expeditiously address environmental concerns associated with the Hanford Site. This strategy is known as the *Hanford Past-Practice Strategy,* DOE/RL-91-40. The strategy emphasizes integration of the results of ongoing site characterization activities into the decision-making process as soon as practicable (a procedure called the Observational Approach) and expedites the remedial action process by emphasizing the use of interim actions.

In 1995, the *Qualitative Risk Assessment for the 100-NR-1 Source Operable Unit,* BHI-00054, identified risks at some source waste sites in the 100-N Area that may warrant remedial action. That same year, the *Qualitative Risk Assessment for the 100-NR-2 Operable Unit,* BHI-00055, determined that some contaminant concentrations in groundwater exceed health-based risk levels. As a result, the Tri-Parties agreed to perform an LFI to determine whether soil remediation is required to protect groundwater from current or future impacts due to past operation of the 116-N-1 and 116-N-3 TSD units. The Tri-Parties also agreed to determine whether soil remediation was required to protect groundwater from a future potential impact and, if so, when remediation should be performed. The results of that project were presented and evaluated in the *1301-N and 1325-N Liquid Waste Disposal Facilities Limited Field Investigation Report*, DOE/RL-96-11, published in 1996.

In February 1998, DOE published the corrective measures study (CMS) (*100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev.0), that was conducted to gather information to support selection of a remedial alternative to address four 100-NR-1 TSD units and two associated sites. The CMS, which is functionally equivalent to a CERCLA feasibility study, described the known characteristics of the waste sites and the distribution and extent of the primary contaminants, presented RAOs, and developed risk reduction goals. In addition, a qualitative risk assessment (QRA), comprised of both human health and ecological risk assessments, was conducted to evaluate current and potential effects of contaminants in the 100-NR-1 OU on human health and the environment. A separate CMS was conducted for other waste sites in the 100-N Area and for the 100-NR-2 Groundwater OU.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both CERCLA and RCRA establish a number of public participation activities that must be conducted prior to implementing a remedial action. Potentially affected individuals and members of the public must be notified of the plans that are being proposed by the responsible and regulatory agencies, and these individuals must be given the opportunity to review alternatives that were evaluated by the agencies. Before making a remedial action decision, the agencies must consider comments and concerns raised by the public and stakeholders. This section describes how the CERCLA requirements for public participation have been met. Because this ROD addresses sites that also must meet RCRA closure and corrective action requirements, this section describes how the RCRA public participation requirements were met. Appendix A of this ROD contains the responsiveness summary to specific comments submitted to Ecology by the public.

In April 1990, the Tri-Parties developed a Community Relations Plan (CRP) as part of the overall Hanford Site restoration. The CRP was designed to promote public awareness of the investigations and public involvement in the decision-making process. The CRP summarizes known concerns based on community interviews. Since that time, several public meetings have been held and numerous fact sheets have been distributed in an effort to keep the public informed about Hanford Site cleanup issues.

On March 16, 1998, the *100-NR-1 Treatment Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-95-111, and the *Proposed Plan for Interim Remedial Action and Dangerous Waste Modified Closure of the Treatment, Storage, and Disposal Units and Associated Sites in the 100-NR-1 Operable Unit*, DOE/RL-97-30 (or Proposed Plan), were made available to the public. The CMS develops a set of potential remedial alternatives for the four

TSD units and two associated sites and performs a detailed analysis of these alternatives. The CMS also contains the TSD unit closure plans, corrective action plans, and RCRA Permit conditions. The Proposed Plan summarizes the results of the analyses performed in the CMS and presents the Tri-Parties' preference for remedial action. These documents were issued as part of the Tri-Parties' public participation responsibilities under Section 117(a) of CERCLA and pursuant to Class 3 RCRA Permit Modification public notice requirements of *Washington Administrative Code* (WAC) 173-303-830. The public participation process concurrently satisfied the requirements of both authorities.

The specific activities that were completed to address the public participation responsibilities included mailing a fact sheet explaining the proposed action to approximately 2,000 people. In addition, an article appeared in the bi-monthly newsletter, the *Hanford Update*, detailing the start of the public comment process. The *Hanford Update* was mailed to over 5,000 people. The Proposed Plans were mailed to all of the members of the Hanford Advisory Board.

The notice of the availability of these documents was published in the *Seattle PI/Times*, the *Spokesman Review-Chronicle*, the *Tri-City Herald*, and the *Oregonian* on March 15, 1998. Additional advertisements ran in the *Tri-City Herald* on April 2, 1998. The public comment period was held from March 16 through April 29, 1998. A combined public meeting and public hearing was held April 2, 1998, at Ecology's office in Kennewick, Washington. At the meeting, representatives from DOE and Ecology answered questions about the project. A response to the comments received during the public comment period, including those raised during the public meeting, is included in the Responsiveness Summary, which is attached as Appendix A to this ROD. This decision document presents the selected interim remedial action at sites in the 100-N Area at the Hanford Site in Richland, Washington. The selected interim remedy is chosen in accordance with CERCLA, as amended by the *Superfund Amendments and Reauthorization Act of 1986*, and to the extent practicable, the National Contingency Plan. The decision for these sites is based on the Administrative Record. The locations of the Administrative Record and the information repositories are listed below.

ADMINISTRATIVE RECORD (contains all project documents)

U.S. Department of Energy
Richland Field Office
Administrative Record Center
740 Stevens Center
Richland, Washington 99352

INFORMATION REPOSITORIES (contain limited documentation)

University of Washington
Suzzallo Library
Government Publications Room
Mail Stop FM-25
Seattle, Washington 98195

Gonzaga University
Foley Center
E. 502 Boone
Spokane, Washington 99258

Portland State University
Branford Price Millar Library
Science and Engineering Floor
SW Harrison and Park
P.O. Box 1151
Portland, Oregon 97207

DOE Richland Public Reading Room
Washington State University, Tri-Cities
Consolidated Information Center, Room 101L
P.O. Box 99, MSIN H2-53
Richland, Washington 99352

IV. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

In 1988, four areas of the Hanford Site were listed on the NPL: the 100 Area, the 200 Area, the 300 Area, and the 400 Area. Each of these areas was further divided into numerous OUs.

To effectively manage environmental compliance and cleanup at the Hanford NPL sites, the EPA, Ecology, and the DOE entered into the *Hanford Federal Facility Agreement and Consent Order*, which is referred to as the Tri-Party Agreement. Within the 100 Area NPL, the Tri-Party Agreement assigned EPA as the lead regulatory agency for the 100-B, C, K, and F Area OUs. Ecology was assigned as the lead regulatory agency for the remainder of the 100 Area OUs, including those in the 100-N Area. The lead regulatory agency approach was selected to minimize duplication of effort and maximize productivity. The role of the lead agency is to oversee the activities at an operable unit to ensure that all applicable requirements are met. The DOE is responsible for performing the remedial actions selected for the OU.

As with many CERCLA NPL sites, the problems in the 100-N Area are complex. As a result, the Tri-Parties organized the work into two separate OUs. The 100-NR-1 OU encompasses all of the soil waste sites, including the associated structures and pipelines in the 100-N Area. The 100-NR-2 OU is the groundwater underlying the 100-NR-1 OU.

The two OUs encompass four distinct components that require interim remedial action:

- Contaminated soils, debris, and underground pipelines associated with past-practice waste sites, including spill sites

- RCRA TSD units and their associated pipelines

- Facilities (e.g., buildings, structures, and pipelines) to be decontaminated and/or taken out of service

- Groundwater beneath the areas listed above.

Two separate CMSs were conducted and two Proposed Plans were issued to address cleanup of the contaminated soils, pipelines, and groundwater. The remaining waste sites within the 100-NR-1 OU (including the 100-N shoreline), as well as the groundwater in the 100-NR-2 OU, are addressed in a separate ROD (Interim Remedial Action Record of Decision, 100-NR-1 and 100-NR-2 Operable Unit, September 1999). An engineering evaluation and cost analysis (EE/CA) was conducted to determine what should be done with the 100-N Area buildings and structures and the cost. An action memorandum has been issued to document the decisions resulting from the EE/CA. Finally, the 100-N Reactor Building is being addressed in a separate program called Interim Safe Storage.

For the sites covered by this ROD, EPA, Ecology, and DOE elected to coordinate response actions under RCRA closure, RCRA corrective action, and CERCLA remedial action. By applying CERCLA authority concurrently with RCRA closure and corrective action requirements, EPA and Ecology are able to address all regulatory and environmental obligations at this OU as effectively and efficiently as possible.

The CMS (*100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan,* DOE/RL-96-39, Rev. 0) fulfilled the corrective action and CERCLA remedial action processes leading up to a decision (i.e., the CMS is functionally equivalent to a CERCLA feasibility study) for describing and analyzing remedial alternatives. In order to fulfill the requirements for the RCRA closure process, the TSD closure/postclosure plans for the 116-N-1 and 116-N-3 Liquid Waste Disposal Facilities were included as appendices in the CMS. The closure strategy for these sites meets Washington State *Model Toxics Control Act* (MTCA) Method B values and the EPA standard of 15 mrem/yr (EPA guidance *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, August 22, 1997) above natural background for radionuclides in soil by removing and disposing of contaminated soil and structures. However, due to the presence of a radionuclide plume associated with the 116-N-1 and 116-N-3 facilities, the sites will be closed pursuant to the RCRA Permit and the Washington State dangerous waste regulations. Groundwater monitoring and institutional control will continue pending the completion of CERCLA groundwater remedial action.

The principal risks posed by the TSD units and associated sites are the potential for human and ecological receptor exposure from waste site contaminants (both radiological and chemical) and the potential for contaminants to migrate to the groundwater and, eventually, to the Columbia River. The objectives of the interim remedial action authorized in this ROD are to reduce potential threats to human health and the environment from these waste sites and not preclude any future land use in the 100 Area. As such, the interim remedial actions described in this ROD address all known current and potential unacceptable risks to human health and the environment from the three sites being addressed in the 100-NR-1 OU. Groundwater will continue to be monitored during the interim remedial action for the 100-NR-2 OU. Any remaining risks will be addressed in a future ROD for the 100 Area NPL site.

V. SITE CHARACTERISTICS

This section presents general facility and operation information about the Hanford Site and the 100-N Area. Also included are detailed descriptions and background discussions for the individual waste sites and the associated contaminants of potential concern (COPCs). The information was compiled from many different sources including the CMS's *100-N Area Technical Baseline Report,* WHC-SD-EN-TI-251; the *RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-NR-1 Operable Unit Hanford Site, Richland Washington,* DOE/RL-90-22; the *Limited Field Investigation Report for the 100-NR-1 Operable Unit,* DOE/RL-93-80; *Qualitative Risk Assessment for the 100-NR-1 Source Operable Unit,* BHI-00054; and the *1301-N/1325-N Liquid Waste Disposal Facilities Limited Field Investigation Report,* DOE/RL-96-11.

Hanford Facility Operations in the 100 Area

Nine water-cooled, graphite-moderated plutonium production reactors were constructed along the Columbia River at the Hanford Site between 1943 and 1963. The 100-N Reactor, the last reactor to be built, is situated in the 100 Area in the northern part of the Hanford Site on a broad strip of land along the Columbia River about 48 km (30 mi) northwest of the city of Richland, Washington. The 100-N Reactor differs from the other reactors at Hanford, not only because of its closed-loop cooling system, but because it was designed as a dual-purpose reactor capable of producing both special nuclear material and steam generation for electrical power. Although called a "closed-loop cooling system," it actually operated as a bleed-and-feed system where a portion of the cooling waters were constantly bled off and replaced with fresh demineralized water. The cooling effluent removed from the loop eventually made its way to the 116-N-1 and 116-N-3 Liquid Waste Disposal Facilities. The 100-N Reactor went into production in December 1963. The Hanford Generating Plant, part of the N Reactor complex, was completed and started producing electrical power in April 1966.

Both the reactor and the generating plant operated continuously, except during periodic shutdowns for maintenance and repairs, until January 7, 1987. The reactor was retired in October 1989, and orders were received to shut down the reactor in October 1991. Figure 1 shows the Hanford Generating Plant and the N Reactor, as well as the sites addressed by this ROD.

TSD Unit and Associated Site Descriptions

116-N-1 Crib and Trench. The 116-N-1 unit is composed of two parts: a crib and a zig-zag-shaped trench. The crib area is approximately 88 m (289 ft) long by 38 m (125 ft) wide. The bottom of the crib is about 1.5 m (5 ft) below the level of the surrounding grade. A sloped soil and gravel embankment forms the walls of the crib. The crib was originally excavated to a depth of about 4.5 m (15 ft) below the level of the surrounding grade. The crib has been backfilled at various times with boulders and cobbles to control the spread of contamination. There are three distinct layers of backfill. The lowest layer is 0.9 m (3 ft) thick and consists of large boulders. The middle layer is 0.6 m (2 ft) thick and is composed of smaller boulders. The upper layer is 1.2 to 1.5 m (4 to 5 ft) thick and consists of cobble-sized material.

The 116-N-1 zig-zag-shaped trench is 490 m (1,608 ft) long by 15 m (49 ft) wide at the top, with sloped side walls. Water spilled over a weir in the dike located on the north side of the crib and into the trench. Pre-cast concrete panels were installed to cover the entire trench to minimize wildlife intrusion and airborne contamination.

116-N-3 Crib and Trench. The 116-N-3 unit is composed of two parts: a crib and a straight trench. The 116-N-3 Crib was put into operation as a replacement for 116-N-1, which had reached its disposal capacity. The 116-N-3 Crib is 76 by 73 m (249 by 240 ft) and is covered by pre-cast concrete panels. The cover is about 1 m below the surrounding surface grade, and the bottom of the crib is 2 m (7 ft) below the cover. A water distribution system in the form of a network of concrete troughs rests on the bottom of the crib. Water flowed from these troughs into the crib. Because of low percolation rates in the soil column, the 116-N-3 Crib was not able to achieve its designed flow capacity, and the straight extension trench was added. The trench is 914 m (2,999 ft) long by 16.8 m (55 ft) wide and is covered with pre-cast concrete panels. The concrete panels are about 1 m below the surrounding grade, and the bottom of the trench is about 3 m (10 ft) below the concrete panels.

Pipelines Associated with 116-N-1 and 116-N-3. Buried pipelines associated with the 116-N-1 and 116-N-3 sites consist of a total of 1,763 m (5,784 ft) of pipe ranging in size from 8 to 91 cm (3.2 to 35.9 in.) in diameter at an average depth of 3.7 m (12 ft). Because there is no process history indicating that the pipes ever leaked, there is no known soil contamination associated with these pipes. Nevertheless, it is possible that leaks have occurred but went undetected. The condition of the pipes, the extent and nature of contamination in the pipes, and the extent and nature of any soil contamination that may be present will be assessed during the remedial design/remedial action phase.

UPR-100-N-31 Unplanned Release. Although UPR-100-N-31 is not a TSD unit, it is associated with the 116-N-1 TSD unit. The waste site was a spill that occurred on July 22, 1974, while sample lines were being installed in a 15-cm (6-in.) steel casing through the berm on the west side of the 116-N-1 Crib. During the sample line installation, the water level in the crib was raised from 38 to 46 cm (15 to 18 in.) as a result of an emergency dump tank drawdown test. Due to the increased water level, approximately 4,000 L (1,056 gal) of effluent water containing fission and activation products flowed through the casing and was discharged to the soil. An area of approximately 188 m^2 (2,023 ft^2) was contaminated. Sand and fines were used to stabilize the soil contamination before its removal to the 200 Area for disposal. After the contaminated soil was removed, clean fill material was used to restore the site. The cleanup that was performed in 1974 was not performed to today's cleanup standards, therefore, there may be some residual contamination at this site.

Waste Disposal Practices

116-N-1 Crib and Trench and 116-N-3 Crib and Trench. The 116-N-1 and 116-N-3 cribs and trenches received radioactive liquid wastes containing activation and fission products, as well as small quantities of corrosive liquids and laboratory chemicals generated by various N Reactor operations. The units used the vadose zone to remove radioactive and hazardous materials from the effluent generated from reactor operations. As discharged effluent percolated through the soil column, most radioactive and chemical constituents were retained in the soil through filtration, absorption, adsorption, and ion exchange. However, some constituents, such as tritium, were not retained in the soil but traveled with the effluent. Eventually the soil's capacity to remove contaminants from the effluent was exceeded, allowing more contaminants to travel to groundwater and on to the Columbia River.

The primary waste sources were the reactor cooling systems and the fuel storage basins. Until December 1984, essentially all the strontium-90 and cesium-137 discharged to 116-N-1 originated in the 100-N Reactor fuel storage basin. The water was discharged to the Liquid Waste Disposal Facilities at an average flow rate of 6,800 L/min (1,800 gal/min).

Various dangerous waste solutions were disposed in the units. These wastes resulted mainly from decontamination of the primary coolant system and from possible disposal of chemicals to common floor drains that discharged to the units. The chemicals that were introduced into the primary coolant system were ammonium hydroxide and hydrazine. Analysis of the primary coolant wastewater in 1985 indicated it did not exhibit any of the characteristics of a regulated dangerous waste. Releases from the periphery cooling systems resulted in small continuous discharges of a variety of chemicals including ammonium hydroxide, morpholine, and hydrazine to the units. Sodium dichromate was used as a corrosion inhibitor in the reactor cooling system and was discharged to the 116-N-1 unit until the early 1970s. Other discharges include drainage from reactor support facilities, five wet laboratories, and the auxiliary power battery lockers. Additional information on the N Reactor waste generating processes is presented in the *100-N Area Technical Baseline Report*, WHC-SD-EN-TI-251.

Spill and Release History

Throughout the operational history of the 100-N Reactor, spills of sufficient quantity to require reporting were documented and are currently identified as unplanned releases, each with a unique number. All spills within the 100-NR-1 OU are addressed in the *Corrective Measures Study for the 100-NR-1 and 100-NR-2 Operable Units*, DOE/RL-95-111 (Section 2.1.3), with the exception of UPR-100-N-31, which is the only spill associated with the TSD units. This spill occurred on July 22, 1974, while sample lines were being installed in a 15-cm (6-in.) steel casing through the berm on the west side of the 116-N-1 Crib. During the sample line installation, the water level in the crib was raised from 38 to 46 cm (15 to 18 in.) as a result of an emergency dump tank drawdown test. As a result of the increased water level, approximately 3,785 L (1,000 gal) of effluent water containing fission and activation products flowed through the casing and were released to the soil. An area of approximately 188 m^2 (2,025 ft^2) was contaminated.

Contaminants of Concern at the TSD Units and Associated Sites

116-N-1 Crib, Trench, and Associated Pipelines. Contaminants of concern in the surface soils in the 116-N-1 Crib (defined as the top 4.6 m [15 ft] below surrounding grade under a rural-residential scenario) were derived from data presented in the CMS (*100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev. 0). The radionuclides of concern include cesium-137, cobalt-60, europium-154, europium-155, plutonium-239/240, strontium-90, and tritium. Historical information indicated that mercury and nitrate may be present (DOE/RL-96-39, Rev. 0). A subsurface soil layer, 0.9 to 1.5 m (3 to 5 ft) thick, exists at a depth greater than 4.6 m (15 ft) below surrounding grade. This subsurface layer beneath the 116-N-1 Crib and Trench contains plutonium-239/240, tritium, chromium, and nitrates in concentrations above cleanup standards. These are retained as contaminants of concern due to very high risk from inadvertent exposure by human or ecological receptors. Modeling based upon current characterization indicates that contaminants will not pose a threat to groundwater; however, monitoring will be required as part of remediation activities to verify the accuracy of the modeling.

116-N-3 Crib, Trench, and Associated Pipelines. Contaminants of concern in the surface soils at the 116-N-3 site (defined as the top 4.6 m [15 ft] below surrounding grade under a rural-residential scenario) were derived from data presented in the CMS (DOE/RL-96-39, Rev. 0). The radionuclides of concern include cesium-137, cobalt-60, europium-154, europium-155, plutonium-239/240, strontium-90, and tritium. Historical information indicated that mercury and nitrate may be present (DOE/RL-96-39, Rev. 0).

A subsurface soil layer, 0.9 to 1.5 m (3 to 5 ft) thick, exists at a depth greater than 4.6 m (15 ft) below surrounding grade beneath the 116-N-3 Crib and Trench. This layer contains plutonium-239/240, tritium, and nitrate that are retained as contaminants of concern due to their very high risk from inadvertent exposure by human or ecological receptors. Modeling based on current characterization indicates that contaminants will not pose a threat to groundwater; however, monitoring will be required as part of remediation activities to verify the accuracy of modeling.

UPR 100-N-31. If residual contamination exists in this area, it is assumed that it would only exist in surface soils (defined as the top 4.6 m [15 ft] below surrounding grade under a rural-residential scenario) and that the same contaminants of concern that are present in the surface soils at 116-N-1, both radionuclides and inorganics, would possibly be present in the surface soils at UPR-100-N-31.

Previous Response Actions

There have been no previous response actions that involved or affected the soil or structures at the TSD units, except for the actions related to the UPR-100-N-31 spill. Sand and fines were used to stabilize the soil contamination prior to removal of the soil for disposal in the 200 Area. After the soil was removed, clean fill material was used to restore the site.

Site-Specific Geology and Hydrogeology

The site-specific geology and hydrogeology at the TSD units are summarized below from the 1301-N/1325-N LFI report (DOE/RL-96-11) for the 116-N-1 and 116-N-3 units.

116-N-1 and 116-N-3. Stratigraphic divisions underlying the 100-N Area include the Hanford formation, the Ringold Formation, and the Elephant Mountain Member of the Saddle Mountains Basalt. The Hanford formation overlies the Ringold Formation and consists of two gravel-dominated facies: an upper cobble-boulder unit and a lower pebble-cobble unit. The Ringold Formation overlies the Elephant Mountain Member and consists of seven units.

Thickness ranges for the Hanford formation and the Ringold Formation are 5.8 to 24.5 m (19 to 77 ft) and 137.2 to 150.6 m (450 to 494 ft), respectively.

The upper portion of the Hanford formation is composed of unconsolidated basaltic cobble and boulder-sized clasts. Cobbles as large as 15 cm (6 in.) were encountered during drilling in the vicinity of the units, although boulders as large as 0.9 m (3 ft) can be seen around 116-N-1 and 116-N-3. Below the cobble-boulder unit, clast size decreases to pebbles and cobbles with local dominant sand. The gravel and sand are predominantly basaltic in composition. Sometimes significant sand layers are intercepted during drilling. Sand layers from 3 to 4.9 m (10 to 16 ft) thick, consisting of very coarse to fine sand, have been encountered. In the vadose zone, sand layers may have promoted the localized lateral spread of contamination from 116-N-1 and 116-N-3 during operation of the units. The sand zones are discontinuous and cannot, with certainty, be traced between wells.

Extensive grading, excavating, and backfilling of the surficial Hanford formation have occurred within and around 116-N-1 and 116-N-3. Consequently, it is difficult to distinguish undisturbed Hanford formation from anthropogenically disturbed Hanford formation because of similar bulk composition. The zone of disturbed material is up to 6.1 m (20 ft) thick and consists of unconsolidated basaltic cobble- to boulder-sized clasts with sand infilling. Clasts often exhibit white calcium carbonate coatings.

The underlying Ringold Formation is composed of fluvial pebble- to cobble-sized gravels with a silty sandy matrix. The sediments range from well-cemented, with carbonates and/or iron oxides, to uncemented. Cementation is discontinuous but laterally extensive. Basalt content of the gravels is typically less than 50% by volume. Some thin discontinuous sand lenses are found in the areas of 116-N-1 and 116-N-3. The contact between the Hanford formation and the Ringold Formation is sometimes difficult to determine because a transition zone of reworked Ringold Formation is often present. The contact is a potential perching layer in the vadose zone because of the cemented nature of the Ringold Unit E. However, no perched water was observed during the 1995-1996 LFI activities.

Groundwater in the unconfined aquifer flows primarily in a west-northwesterly direction most of the year and discharges to the Columbia River. Fluctuations in river stage, because of dam operations and seasonal variations, can impact the flow direction, hydraulic gradients, and groundwater levels within the unconfined aquifer. The significant stratigraphic divisions at and above the water table at 116-N-1 and 116-N-3 are the Ringold Formation and the Hanford formation. The unconfined aquifer is contained in the gravel-dominated Unit E lithofacies of the Ringold Formation.

Figure 2 provides a stratigraphic cross section in the areas of the two TSD units and the associated site. As stated previously, the approximate depth to groundwater in the vicinity of the TSD units and associated site ranges from 117 to 119 m.

Ecological Analysis

Ecological surveys and sampling have been conducted in the 100 Areas and in and along the Columbia River adjacent to the 100 Areas. Sampling included plants with either a past history of documented contaminant uptake or an important position in the food web, such as river algae, reed canary grass, tree leaves, and asparagus. In addition, samples were collected of caddisfly larvae (next step in the food chain from algae), burrow soil excavated by mammals and ants at waste sites, and pellets cast by raptors and coyote scat to determine possible contamination of the upper end of the food chain. Bird, mammal, and plant surveys were conducted and reported in *100 Area CERCLA Ecological Investigations*, WHC-EP-0620. Contamination data have been compiled from other sources, as well as ecological pathways and lists of all wildlife and plants at the site, including threatened and endangered species.

As indicated in various *Hanford Site Environmental Reports*[7], analysis of terrestrial and aquatic wildlife for radionuclides have indicated that some species have accumulated levels of radionuclides greater than background. Strontium-90 has been detected in the offal of Columbia River whitefish and suckers at levels slightly exceeding levels found in a population of whitefish upstream in the Wenatchee River. Significant levels of strontium-90 have been found in skulpins. Elevated levels of strontium-90 have also been measured in goose bone and eggshells collected from Hanford Reach islands and a background island upstream of the Hanford Site. Collectively, the levels of radionuclides measured in Hanford fish and wildlife indicated accumulations of small amounts of specific radionuclides that possibly originated either from historic fallout or Hanford Site activities.

Cultural Resources Review

Thirty-one archaeological sites have been recorded within 2 km (1.2 mi) of the 100-N Area perimeter. Four of these sites are either listed, or are considered eligible for listing, on the National Register. Three sites, two house pit villages, and one cemetery comprise the Ryegrass Archaeological District. The Hanford Generating Plant site is already listed in the National Register. Three areas near the 100-N Area are known to have been of some importance to the Wanapum. The knobs and kettles surrounding the area may have been called *Moolimooli*, which means "Little Stacked Hills." Sites of religious importance may also exist near the 100-N compound.

Sixty-six Cold War-era buildings and structures have been inventoried in the 100-N Area. Thirty 100-N Area buildings/structures have been determined eligible for the National Register as contributing properties within the Hanford Site Manhattan Project and Cold War Era Historic District. These include the 105-N Reactor, 109-N Heat Exchanger Building, 1112-N Guard Station, 181-N River Water Pump House, 183-N Water Filter Plant, 184-N Plant Service Power House, and 185-N Export Powerhouse. Effects to these eligible properties, up to and including demolition, have been mitigated through documentation contained in the *N Reactor Comprehensive Treatment Report, Hanford Site, Washington,* DOE/RL-96-91, the "Reactor Operations" section of Chapter 2 of the Historic District Treatment Report (to be completed in fiscal year 2000), and individual Historic Property Inventory Forms. This mitigation was

[7] Prepared and published annually for DOE by the Pacific Northwest National Laboratory under Contract DE-AC06-76RLO 1830, the most recent of which is the *Hanford Site Environmental Report for Calendar Year 1997*, PNNL-11795, September 1998.

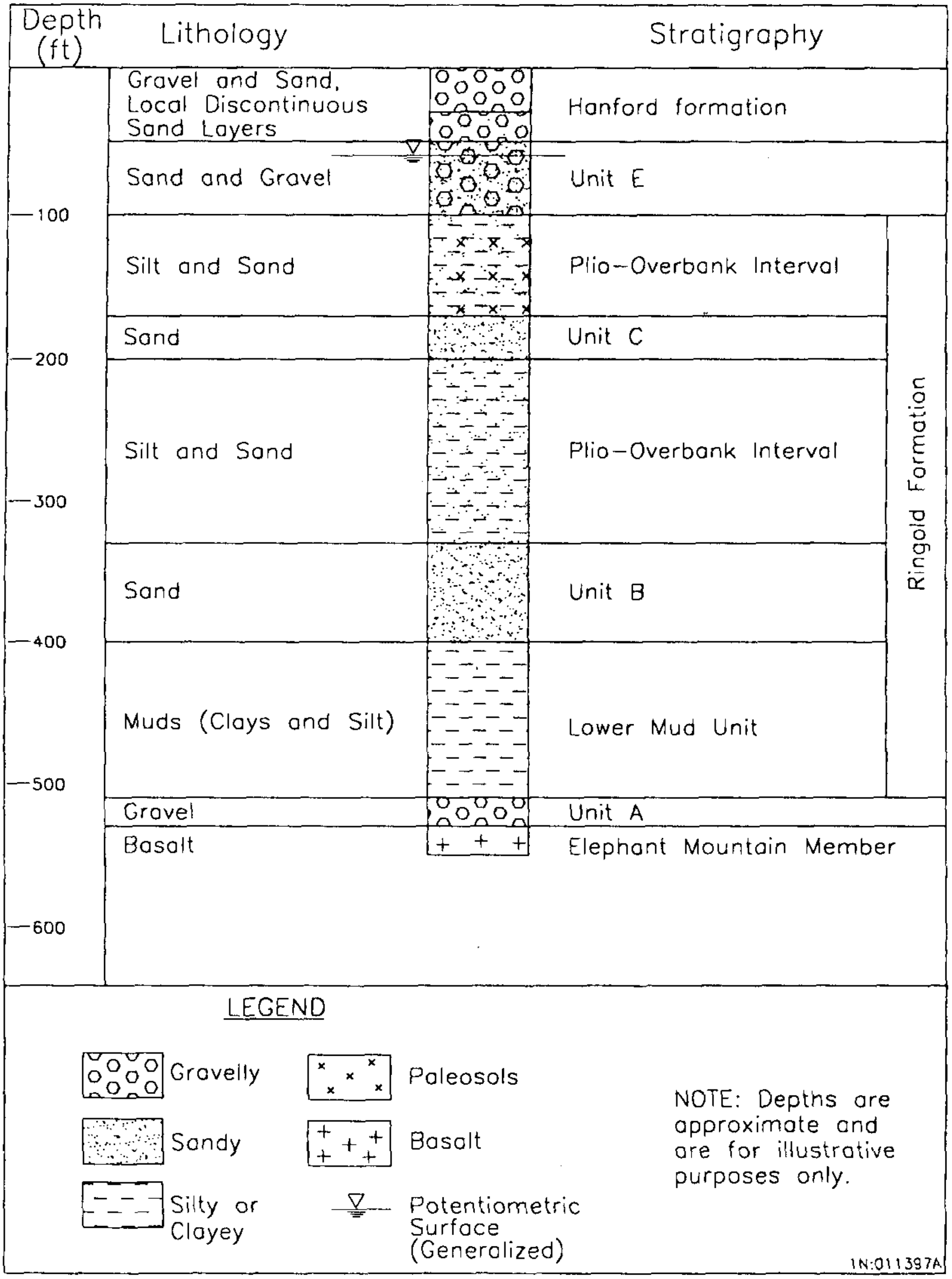

Figure 2. General Stratigraphic Cross Section for 116-N-1 and 116-N-3.

authorized under a programmatic agreement[8], and was conducted through the ongoing Historic Buildings Mitigation Project. However, as required by Stipulation V (C) of the Programmatic Agreement, assessments of the contents of the contributing properties need to be performed prior to any deactivation, decontamination, or decommissioning activities. The purpose of an assessment will be to locate and identify any artifacts (e.g., control panels, signs, scale models, etc.) that may have interpretive or educational value as exhibits within local, state, or national museums.

Nature and Extent of Contamination and Investigative Approach.

The results of the 100-N Area investigations are described in the following paragraphs.

Limited field investigations were undertaken for the 100 Area OUs in a manner consistent with the *Hanford-Past Practice Strategy* for waste sites that were considered to be candidates for interim remedial measures. The LFI included data compilation, nonintrusive investigations, intrusive investigations, 100 Area aggregate studies, and data evaluation. The purpose of the LFI reports was to identify those sites that are recommended to be candidates for interim remedial measures, provide a preliminary summary of site characterization studies, refine the conceptual model as needed, identify contaminant- and location-specific applicable or relevant and appropriate requirements (ARARs), and provide a qualitative assessment of the risks associated with the sites. The assessments included consideration of whether contaminant concentrations pose an unacceptable risk that warrants action through interim remedial measures. The preamble to EPA's *National Contingency Plan* (55 *Federal Register* 8666) states that interim actions are appropriate to remediate sites in phases in order to eliminate, reduce, or control the hazards associated with a site or to expedite the completion of a total site cleanup. According to this preamble, a balance must be achieved in the desire to definitively characterize site risks in detail with the desire to implement protective measures quickly. EPA's intent was expressed in the preamble as a bias for action in order to eliminate, reduce, or control hazards posed by a site as early as possible. The interim remedial measures are intended to achieve remedies that are expected to be consistent with final actions and a final ROD.

VI. SUMMARY OF SITE RISKS

Potential risks to human health and ecological receptors have been evaluated in a QRA for individual waste sites in the 100-NR-1 OU. The primary objective of the results of the QRA was to make a "yes" or "no" determination with respect to whether individual sites should be considered as candidates for an interim remedial measure.

The QRA consisted of contaminant identification, exposure assessment, toxicity assessment, and human health, as well as ecological risk characterization. The contaminants of concern were identified based on historical sampling data and radionuclide inventories, as well as from the results of LFI studies. The exposure assessment identified potential exposure pathways for

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[8] *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington,* DOE/RL-96-77, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

future users of the sites. Current site risks to workers were not evaluated because no workers are located at the sites. The toxicity assessment evaluated the potential health effects to human or ecological receptors as a result of exposure to contaminants. Exposure scenarios evaluated potential use scenarios (frequent use and occasional use) in which the onset of exposures are delayed until the year 2018, based on the Tri-Party Agreement milestone for completion of remediation in the 100 Area.

Qualitative Risk Assessment (QRA) Methodology. The QRA methodology consisted of an evaluation of risk for a defined set of human and environmental exposure pathways and scenarios. This methodology is not intended to be a replacement or substitute for a baseline risk assessment. For the 100-N Area waste sites addressed in this ROD, the QRA considered a frequent use human health exposure scenario with four exposure pathways (i.e., soil ingestion, fugitive dust inhalation, inhalation of volatile organic compounds from soil, and external radiation exposure) and a limited ecological assessment. The frequent-use scenario is generally similar to a rural residential scenario.

Adverse human health effects resulting from exposure to chemical contaminants are identified as either carcinogenic (i.e., causing development of cancer in one or more tissues or organ systems) or non-carcinogenic (i.e., direct effects on organ systems, reproductive and developmental effects). High-priority sites that are addressed in this ROD pose unacceptable risk(s) through one or more pathways sufficient to recommend an action via an interim remedial measure.

Assessment of ecological risk concentrated on potential adverse effects to the Great Basin pocket mouse. The pocket mouse has a home range that is approximates the size of many of the waste sites. Furthermore, the pocket mouse is part of the terrestrial food chain at the Hanford Site for the loggerhead shrike, which is a candidate endangered species.

Identification of Contaminants of Concern. Contaminants of concern were identified through an evaluation of both historical data and LFI data. Contaminants that were present in the top 4.6 m (15 ft) of soil were included in the evaluation. The higher concentration from either the historical data set or the LFI were selected for evaluation in the QRA. Table 2 shows the contaminants of potential concern at the 116-N-1 and 116-N-3 sites. The definition of potential site risk and subsequent development of remedial alternatives in the CMS were based on establishing preliminary remediation goals that comply with risk-based ARARs or to be considered (TBC) requirements.

Radionuclide preliminary remediation standards protective of human health were calculated based on the EPA guidance level of 15 mrem/yr above natural background in soil for all pathways. The RESidual RADioactivity (RESRAD) model was selected as the dose assessment model for generating preliminary remediation goals (PRGs) for radionuclide contaminants in soil. The model is used to determine individual radionuclide concentrations (pCi/g) in soil that corresponds to a dose rate of 15 mrem/yr above background. The RESRAD model was also used to demonstrate that some residual soil contaminants, both radiological and nonradiological, will not reach the unconfined aquifer by migration through the soil column within one thousand

Table 2. Remedial Action Goals for Contaminants of Potential Concern at the 116-N-1 and 116-N-3 TSD Units

Contaminants of Potential Concern	Remedial Action Objective – Protection from Direct Exposure		Remedial Action Objective -Protection of Groundwater/Columbia River	
	Remedial Action Goal for Nonradionuclides (mg/kg)	Remedial Action Goal for Radionuclides (pCi/g)[a]	Contaminant-Specific Concentration in Soil Protective of Groundwater (pCi/g or mg/kg)	Contaminant-Specific Concentration in Soil Protective of the Columbia River (pCi/g or mg/kg)
Cesium-137	NA	6.1	b	b
Cobalt-60	NA	1.4	b	b
Europium-154	NA	3.1	b	b
Europium-155	NA	127	c	c
Plutonium-239/240	NA	23.5	b	b
Strontium-90	NA	3.7	b	b
Thorium-228	NA	2.2	b	b
Thorium-232	NA	0.94	b	b
Tritium (H-3)	NA	241	2,000	5,630
Uranium-233/234	NA	101	2	4
Uranium-238	NA	69	2.4	4.8
Cadmium	80	NA	b	b
Chromium (VI)	400	NA	8	2
Lead	353	NA	b	b
Mercury	24	NA	b	b
Nitrate	1.13×10^5	NA	4,400	4,400

[a] Single radionuclide soil concentrations corresponding to a 15 mrem/yr dose.
[b] The RESRAD and unit gradient models predict the contaminant will not reach groundwater within a 1,000-year time frame. It is anticipated that sampling will be required to verify that cleanup has been achieved, and that contaminants left in place are not migrating.

years. For drinking water, the radionuclide remediation standard is an annual dose equivalent to the total body or any internal organ of 4 mrem/yr based upon the average annual activity of beta particle and photon radioactivity from man-made radionuclides. These remediation goals are consistent with other cleanup activities in the 100 Areas. Radionuclide preliminary remediation goals protective of ecological receptors were calculated based on a draft DOE standard of 0.1 rad/day for terrestrial animals and 1.0 rad/day for aquatic receptors. For nonradionuclides, preliminary remediation goals for soils were defined by risk-based ARARs in the Washington State *Model Toxics Control Act* (MTCA). Both human and ecological receptors were considered protected by MTCA Method B values for soils with the exception of hexavalent chromium (Cr^{+6}) which is using the ambient water quality criteria of 11 ppb. Remediation goals for nonradioactive contaminants in water, protective of groundwater, are based on maximum contamination levels (MCLs) and MTCA Method B levels. A listing of contaminants of concern that potentially may be found at 100-NR-1 TSD units, along with their respective preliminary remediation goals, is contained in Table 2.

Toxicity Assessment. All radionuclides are classified by EPA as Group A human carcinogens due to their property of emitting ionizing radiation. For radium, this classification is based on direct human epidemiological evidence. For the remaining radionuclides, this classification is based on the knowledge that these elements are deposited in the body, delivering calculable doses of ionizing radiation to the tissues. Despite differences in radiation type, energy, or half-life, the health effects of ionizing radiation are identical but may occur in different target organs and at different activity levels. Cancer induction is the primary human health effect of concern resulting from exposure to radioactive environmental contamination, since the concentrations of radionuclides associated with significant carcinogenic effects are typically orders of magnitude lower than those associated with systemic toxicity. The cancers produced by radiation cover the full range of carcinomas and sarcomas, many of which have been shown to be induced by radiation. The EPA's health assessment summary tables are used as the source of radionuclide information including half-lives, lung class, gastro-intestinal absorption, and slope factors.

Quantification of Carcinogenic Risk. For carcinogens, risks are estimated as the likelihood of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen (i.e., incremental or excess incremental cancer risk [ICR]). The equation for risk estimation is:

$$\text{ICR} = (\text{Chronic Daily Intake})\ (\text{Slope Factor})$$

This linear equation is only valid at low-risk levels (i.e., below estimated risks of 1×10^{-2}) and is an upperbound estimate of the upper 95th percent confidence limit of the slope of the dose-response curve. Thus, one can be reasonably confident that the actual risk is likely to be less than that predicted. Contaminant-specific ICRs are assumed to be additive so that ICRs can be summed for pathways and contaminants to provide pathway, contaminant, or subunit ICRs.

Quantification of Noncarcinogenic Risk. Potential human health hazards associated with exposure to noncarcinogenic substances, or carcinogenic substances with systemic toxicities other than cancer are evaluated separately from carcinogenic risks. The daily intake over a specified time period (e.g., lifetime or some shorter time period) is compared to a reference dose (RfD) for a similar time period (e.g., chronic RfD or subchronic RfD) to determine a ratio called the hazard quotient (HQ). Estimates of intakes for both the frequent-use and occasional-use scenarios are based on chronic exposures. The nature of the contaminant sources and the low probability for sudden releases of contaminants from the subunits preclude short-term fluctuations in contaminant concentrations that might produce acute or subchronic effects.

The formula for estimation of the HQ is:

$$\text{HQ} = \text{Daily Intake/RfD}$$

If the HQ exceeds unity, the possibility exists for systemic toxic effects. The HQ is not a mathematical prediction of the severity or incidence of the effects, but rather is an indication that effects may occur, especially in sensitive subpopulations. If the HQ is less than unity, then the likelihood of adverse noncarcinogenic effects is small. The HQ for all contaminants for a specific pathway or a scenario can be summed to provide a hazard index (HI) for that pathway or scenario. The RfDs are route-specific. Currently, all of the RfDs in IRIS are based on ingestion and inhalation; none have been based on dermal contact. Until more appropriate dose-response factors are available, the oral RfDs should be used to evaluate dermal exposures. The uncertainty regarding these assumptions is discussed below in the uncertainty section.

Human Health Qualitative Risk Assessment. The human health QRA for the 100-NR-1 OU (BHI-00054, Rev.1) provided estimates of risk that might occur under frequent-use (i.e., residential) or occasional-use (i.e., recreational) scenarios based on the best available knowledge of current contaminant conditions. The QRA does not represent actual risks since no use of high-priority sites currently occurs. Furthermore, potential adverse effects of exposure to radionuclides factored in decay until the year 2018. Risk characterization for the individual waste sites differs depending on the type and amount of data available for the specific waste site. Risk characterization was conducted in accordance with the *Hanford Site Risk Assessment Methodology* (DOE/RL-91-45, Rev. 3). The risk characterization for each site was performed by calculating contaminant-specific ICRs and HQs and then summing contaminant-specific risks to obtain a risk estimate for the waste site. For sites where sampling data were not available to calculate ICRs and HQs, the risk characterization consisted of a qualitative discussion of the site, the potential threat posed by the site and the confidence in the information available to assess the threat. Risk estimates from analogous sites were used, where appropriate, to qualitatively determine possible contaminants and potential risk levels.

The QRA for the 100-NR-1 OU determined that the human health risk levels under either the residential or non-residential-use scenario for waste sites 116-N-1 and 116-N-3 are very high, with estimated ICR values greater than 1×10^{-2}. Thus, these sites pose a high risk to human health. The estimated HQ values for 116-N-1 and 116-N-3 were less than 1.0.

Under the rural-residential exposure scenario used, occupancy of the land surface was assumed to be continuous for 365 days/year for a period of 30 years. It was assumed that human receptors could come into direct contact with contaminants in soil to a depth of 4.6 m (15 ft) because basements or other subsurface structures could be constructed within the site (excavation to 3.7 m [12 ft] with a 0.9-m [3-ft] buffer of clean soil). It was considered reasonable to assume that, beyond the 4.6-m depth, soils would remain undisturbed by human activities and that direct contact with deeper contaminants (greater than 4.6 m) would not occur. Under this rural-residential scenario, the unconfined aquifer underlying the 100-N Area would not be used as a potable water supply or for irrigation purposes for approximately 300 years (the estimated maximum time required for remediation of the unconfined aquifer). However, 0.76 m/yr (30 in./yr) of irrigation water from an offsite, uncontaminated source was assumed and included in the exposure evaluations.

The rural-residential exposure model assumes that direct human exposure to radionuclide contaminants within the top 4.6 m of soil occurs through ingestion of contaminated soil, inhalation of suspended dust, and external exposure to radiation. Indirect exposure pathways were by consumption of locally acquired vegetables, meat, fish, and milk. Exposure to nonradioactive contaminants in soil was based solely on the soil ingestion pathway per MTCA protocol. In some cases, there may be no contaminants in the top 4.6 m of soil at a site. In these instances, there would be no exposure through these pathways. For contaminants in soils deeper than 4.6 m, the concern was the potential migration of contaminants to groundwater and eventually to the Columbia River.

The CMS for the 100-NR-1 OU qualitatively evaluated potential human health risk by comparing data applicable to waste sites 116-N-1 and 116-N-3 to risk-reduction or risk-based remedial action goals. Conceptual exposure models that consider the potential contaminants, receptors, and exposure pathways (through which the contact with humans might occur) aided the evaluation. The model demonstrates whether humans could be exposed to contaminants in soil at concentrations above acceptable levels through ingestion of soil, inhalation of suspended dust, and external exposure to radiation. The results of applying the model and conducting the qualitative evaluation indicated that contamination at waste sites 116-N-1 and 116-N-3 poses an unacceptable health risk to future users of these sites and that interim remedial actions should be taken to minimize potential risks of exposure to contaminants at concentrations above acceptable levels. In this evaluation it should be noted that waste site UPR-100-N-31 is considered to be a part of 116-N-1 for purposes of remedial action.

The potential for direct human exposure to contaminants in soil at a depth greater than 4.6 m (15 ft) is unlikely. However, these deeper contaminants could migrate to groundwater. The potential for such migration was also considered in determining the need to remediate waste sites. Past disposal of liquid waste to the soil in the 100-N Area has impacted the underlying groundwater. If groundwater under the site were to be used, future users could be exposed to contaminants. The existing groundwater contamination that resulted from the 100-N Area is part of the 100-NR-2 OU and is addressed in a separate ROD (Interim Remedial Action Record of Decision, 100-NR-1 and 100-NR-2 Operable Unit, September 1999). Groundwater will continue to be monitored during the interim remedial action for the 100-NR-2 OU.

Summary of Key Uncertainties in the Human Health Risk Assessment. In general, the QRA is based on a limited data set. Uncertainties are associated with the contaminants identified for each waste site and the concentrations of the contaminants. Collected samples may not be representative of conditions throughout the waste site, and historical data may not accurately represent current conditions. Because the samples may not be completely representative of the site, risks may be underestimated or overestimated. However, human health risk estimates are based on conservative assumptions that tend to overstate the level of potential risk. Actual risks associated with the 100-NR-1 sites are likely to be lower than presented.

External exposure slope factors for radionuclides are appropriate for a uniform contaminant distribution, infinite in depth and areal extent (i.e., an infinite slab source), with no clean soil cover. For high-energy gamma emitters (e.g., cobalt-60 and cesium-137), the assumption of an infinite slab source can only be satisfied if these radionuclides extend to nearly 2 m (6 ft) below ground surface and over a distance of a few hundred meters or more. If the site being evaluated is smaller than this, or if the site has a clean soil cover, then use of external exposure slope factors is likely to provide risk estimates that may be unrealistic. The fact that the external exposure pathway is the risk driver at many waste sites is not surprising and, in some cases, may be indicative of the conservatism built into the evaluation of this pathway rather than the actual associated risk. However, even with the conservative nature of the evaluation, these sites are still considered to pose a threat to human health and the environment.

For noncarcinogenic chemicals, the RfDs are used as benchmarks for toxic endpoints of concern. The RfDs are derived from data obtained from studies in animals or humans using modification and uncertainty factors that account for uncertainty in the information used to derive the RfD. Uncertainty factors are applied to extrapolate no-observed-effects-levels (NOEL) to obtain the RfDs used in the risk assessment. A factor of 10 is usually applied to reflect the level of each of the sources of uncertainty listed below:

- Use of lowest observed effect level (LOEL) or other parameters that are less conservative than NOEL

- Use of data from short-term exposure studies to extrapolate to long-term exposure

- Use of data from animal studies to predict human effects

- Use of data from homogeneous animal populations or healthy human populations to predict effects in the general population.

A modifying factor may also be incorporated into the RfD to reflect qualitative professional judgments regarding scientific uncertainties not considered by the uncertainty factor, such as the completeness of the database and the number of animals in the study.

Ecological Qualitative Risk Assessment. The purpose of the ecological QRA is to estimate the ecological risks from existing contaminant concentrations in the 100-NR-1 OU. The Great Basin pocket mouse was selected as the representative receptor for terrestrial waste sites in the *Hanford Site Risk Assessment Methodology* (DOE/RL-91-45, Rev. 3). This species was chosen to represent the large number of possible animal receptors, such as rodents, hawks, and large mammals. The Great Basin pocket mouse would be more exposed to site contaminants than many other ecological receptors, thereby providing a conservative estimate of risk. Thus, the assessment and measurement endpoint for the ecological QRA is the health and mortality of the pocket mouse.

Contaminants found in the soil at waste sites in the 100-NR-1 OU include radioactive and nonradioactive elements. For nonradioactive elements, ecological effects were evaluated from uptake from the soil by plants and by accumulation of these elements through the foodweb. Radioactive elements have ecological effects resulting from their presence in the environment (e.g., external dose) and from ingestion (e.g., dose from contaminated food consumption), resulting in a total body burden. Total radiological dose to an organism can be estimated as the sum of doses (weighted by energy of radiation) received from all radioactive elements ingested, residing in the body, and available in the organism's environment.

The radiological dose an organism receives is usually expressed as "rad/day." All exposure pathways are added in determining total organism dose. Internal exposure includes both body burden (i.e., contaminants that are taken into the body from all pathways) and dose from recent food consumption that is still in the gut. The dose to the Great Basin pocket mouse was used to screen the level of risk of an individual waste site. For radionuclides, dose to the pocket mouse is compared to 1 rad/day. For nonradiological contaminants, the dose was compared to toxicity values.

Contaminant doses to the Great Basin pocket mouse were estimated assuming the food pathway was the primary route of exposure to both radioactive and nonradioactive contaminants. The estimated contaminant doses were compared to acceptable doses (ecological benchmarks) for animals. This comparison is expressed as a ratio, the environmental hazard quotient (EHQ). An EHQ equal to or greater than 1 may indicate a potential unacceptable risk to ecological receptors.

The QRA for the 100-NR-1 OU determined that risk levels for waste sites 116-N-1 and 116-N-3 are high, with estimated EHQ values greater than 1. Thus, these sites may pose an unacceptable risk to ecological receptors. The major portion of the risk to the Great Basin pocket mouse at 116-N-1 and 116-N-3 was attributable to strontium-90, while cobalt-60, cesium-137, and plutonium-239/240 comprised the remainder of the risk.

Summary of Key Uncertainties in the Ecological Evaluation. A significant source of uncertainty in the exposure scenario is that the waste site is uniformly contaminated and, in the case of the Great Basin pocket mouse, that all food is assumed to be contaminated. No provision is made for dilution of contaminated food by noncontaminated food. It was also assumed contaminants were not passed through the gut but were completely retained (100% absorption efficiency). However, ecological health risk estimates are based on conservative assumptions that tend to overstate the level of potential risk. Actual risks associated with the 100-NR-1 sites are likely to be lower than presented.

To complete the QRA it was necessary to use data from surrogate organisms in place of the Great Basin pocket mouse since site data are not available for this organism. This contributes to overall QRA uncertainty. In addition, transfer coefficients used to model uptake of contaminants from soil to plants were not Hanford-specific, the approach did not consider whether roots of a plant actually grow deep enough to contact a contaminant, and the model did not account for reduced concentrations from plant to seed (it was assumed the seed concentration was the same as the plant). The Great Basin pocket mouse's food consumption rate was generalized and seasonal behavior (hibernation) that would reduce exposure and body burden was not considered. Uncertainty associated with wildlife toxicity values is significant, particularly for nonradiological contaminants. The approach used in the QRA tends to build conservatism into the toxicity value.

VII. REMEDIAL ACTION OBJECTIVES

The two TSD units, the 116-N-1 and 116-N-3 Cribs and Trenches, and the associated site, UPR-100-N-31 Unplanned Release, contain radioactively and chemically contaminated soils, structures, and/or pipelines. Actual or threatened releases of hazardous substances from the waste sites, if not addressed by implementing the response actions selected in this interim remedial action, may present an imminent and substantial endangerment to the public health, welfare, or the environment. A sulfate plume with concentrations above the secondary drinking water standard is attributable to the operation of these units. Because these disposal facilities pose a potential threat to human health and the environment, and to meet RCRA closure and corrective action standards, additional sampling will be conducted as per an approved sampling and analysis plan. These units will be closed pursuant to the RCRA Permit and Washington State dangerous waste regulations. Soils will be remediated and disposed of as necessary based on the results of additional sampling, and the sites will be backfilled, regraded, and revegetated.

Remedial action objectives are site-specific goals that define the extent of cleanup necessary to achieve the specified level of remediation that will remove the current or potential threat and meet closure requirements applicable at the site. The RAOs are derived from site risks, ARARs, the points of compliance, and the restoration time frame for the remedial action. A key component in the identification of RAOs is the determination of current and potential future land use at the site. The RAOs were formulated to meet the overall goal of both RCRA and CERCLA, which is to provide protection to overall human health and the environment.

It is anticipated that cleanup actions may generate wastes that are regulated as dangerous wastes under WAC 173-303. Compliance with RCRA ARARs including the substantive requirements for storage and RCRA land disposal restrictions will be achieved should dangerous waste be generated. It is not anticipated that wastes will be generated during selected interim actions that are significantly different from a dangerous waste perspective than wastes generated at other 100 Area remedial actions with one exception. Wastes generated during 100-NR-1 OU remedial actions that originated from or have come in contact with contaminated soil or debris from the 116-N-1 and 116-N-3 Cribs and Trenches may be defined as state-only listed waste (F003 due to methanol) in accordance with the Part A RCRA Permit Application for these units. It is anticipated that these F003 wastes will meet ERDF waste acceptance criteria without the need for treatment due to very low concentrations of methanol.

The RAOs identified for this interim action are as follows:

- Protect human and ecological receptors from exposure to radioactive contaminants in surface and subsurface soils, structures, and debris. Exposure routes include ingestion and inhalation, as well as external radiation exposure from radionuclides. Protection will be achieved by reducing concentrations of contaminants in the upper 4.6 m (15 ft) of soil. Soils will also be removed to a depth of 1.5 m (5 ft) below the engineered structures of the 116-N-1 and 116-N-3 cribs and trenches that contain plutonium-239/240. The levels of reduction will be such that the total dose does not exceed 15 mrem/yr above Hanford Site background[9] for 1,000 years following remediation. The 1,000-year requirement ensures that the proposed standard accounts for decay of radionuclides to daughter products that are more highly radioactive.

- Protect potential human and ecological receptors from exposure to nonradioactive contaminants present in the upper 4.6 m (15 ft) of soil and debris. Exposure routes

[9] Steve Luftig and Larry Weinstock, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, OSWER No. 9200.4-18, dated August 22, 1997, U.S. Environmental Protection Agency, Washington, D.C.

include ingestion, inhalation, or dermal exposure. Protection will be achieved by reducing concentrations of contaminants in the upper 4.6 m (15 ft) of soil to the State of Washington MTCA Method B levels or alternates as allowed by MTCA (see Table 2).

- Protect the unconfined groundwater system from adverse impacts by reducing concentrations of radioactive and nonradioactive chemical contaminants present in the soil column that could migrate to the groundwater. Contaminant levels will be reduced so concentrations reaching the groundwater do not exceed the State of Washington MTCA Method B levels or maximum contaminant levels (MCLs) (see Table 2).

- Protect the Columbia River from adverse impacts so that designated beneficial uses are maintained. Protect associated potential human and ecological receptors using and living in the river from exposure to radioactive and nonradioactive chemical contaminants. Protection will be achieved by reducing concentrations of, or limiting exposure pathways to, contaminants present in the soil column that could migrate to the groundwater and eventually to the river. Contaminant levels will be reduced so that concentrations reaching the river do not exceed MTCA Method B values, MCLs promulgated under the federal *Safe Drinking Water Act*, the State of Washington's Drinking Water Standards, ambient water quality criteria (AWQC), or the State of Washington's "Surface Water Quality Standards" (including a Cr^{+6} standard of 10 ppb) (WAC 173-201A-040), whichever is most stringent.

- Prevent destruction of significant cultural resources and sensitive wildlife habitat. Minimize the disruption of cultural resources and wildlife habitat in general and prevent adverse impacts to cultural resources and threatened or endangered species.

These remedial action objectives will be achieved through implementation of the interim remedial actions selected in this document. Remediation will incorporate the Observational Approach, which relies on combining characterization and remediation steps to maximize the use of resources. The Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) for the implementation of this ROD shall include a comprehensive implementation schedule to achieve RAOs.

Remediation Time Frame. Interim remediation (actual cleanup) for 116-N-3 will begin in July 2000 and, at the completion of 116-N-3 remediation (approximate duration of 15 months), the closure activities at 116-N-1 will begin. The approximate duration of completion for the two TSD units is 3 years. The RDR/RAWP for the implementation of this ROD will include a comprehensive implementation schedule to achieve RAOs.

VIII. DESCRIPTION OF ALTERNATIVES

A number of remedial action alternatives were evaluated in the CMS (*100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev. 0, February 1998). The alternatives evaluated include no action, remove/treat/dispose, institutional controls, containment, and in situ and ex situ treatment. The objectives of the interim remedial actions authorized in this ROD are to reduce potential threats to human health and the environment and facilitate unrestricted future land use in the 100 Areas. Only the remove/treat/dispose remedial alternative is consistent with unrestricted future land use at the 116-N-1, 116-N-3, and UPR-100-N-31 waste sites. Although it would be inconsistent with the unrestricted land-use objective, in accordance with CERCLA, the no action alternative is required to be evaluated as a baseline for comparative analysis. Therefore, the remove/treat/dispose and the no action remedial alternatives are addressed in this interim action ROD. The other alternatives evaluated in the CMS are briefly described below because, should future decisions restrict certain land uses, exposure scenarios and resultant alternative analyses will be reevaluated.

Summary of Alternatives at the 116-N-1, 116-N-3, and UPR-100-N-31 Sites

No Action Alternative. The no action alternative was evaluated to provide a baseline for comparison to the other alternatives. This alternative represents a situation where no additional restrictions, controls, or remedial actions are applied to a site. The no action alternative would not support an objective of not precluding any future land use in the 100 Areas. Cost to implement this alternative at 116-N-1, 116-N-3, and UPR-100-N-31 would be negligible.

Institutional Controls. Institutional controls are physical and legal barriers to prevent access to contaminants. Physical institutional control technologies may or may not include fences, but do include warning signs and security personnel. Legal institutional controls include restrictions on land use through permits, zoning ordinances, and/or restrictive covenants. Institutional controls considered in the CMS include access control and land-use restrictions. Controlling site access involves temporary or permanent physical restrictions to prevent or reduce expose to site contaminants. Land-use restrictions are administrative actions to prevent or reduce future human exposure to contaminants remaining on site. The advantage of institutional controls is that they do not require contact with contaminated media and they are relatively simple to implement at low cost. The disadvantage of institutional controls is that they do not effectively achieve the standard remedial measures of performance and they require continual monitoring.

Containment Technologies. The primary containment technology evaluated in the CMS is capping. Capping places a surface barrier over contaminated soil and buried waste to reduce the amount of water infiltrating through the waste, reduce wind and water erosion, and reduce the direct exposure to the waste. Cap designs generally have multiple layers for different functions. Surface layers control wind and water erosion, while lower layers are intended as capillary breaks, high-permeability horizontal drainage layers, biointrusion barriers, and low-permeability layers. Three cover or capping designs were evaluated as being potentially applicable for remediation of the RCRA TSD units. In order of overall performance and environmental protection, they are the Modified RCRA Subtitle C Barrier, Standard RCRA Subtitle C Barrier, and the Modified RCRA Subtitle D Barrier.

In Situ Treatment Technologies. The in situ treatment technologies evaluated in the CMS were electrokinetic separation, biodegradation, solidification through injection or mixing, and vitrification. Electrokinetics uses a direct-current electric field to manipulate the movement of colloidal particles or macro molecules in order to separate/remove them from either the soil matrix or groundwater. This technology is currently at the demonstration stage of development and requires further testing before it can be considered for full-scale remediation. In situ biodegradation describes a wide range of process options that rely on microbial transformation of organic contaminants to effect cleanup of soils, groundwater, and/or other contaminated media. Biodegradation is a natural process by which indigenous microorganisms either completely mineralize organics into carbon dioxide and water (and biomass) or partially transform organic molecules into specific intermediates. In situ biodegradation is effective on organic contaminants in soils but is not effective on radionuclides or inorganics. In situ solidification is conducted in situ by the injection or mixing of solidification agents for the purpose of immobilizing the contaminants. This technology can be beneficial in that the contaminated soils are not removed which reduces the risk of exposure to workers and the surrounding environment. The disadvantage of in situ solidification is that there are uncertainties associated with the degree of mixing between the injected agent and the soils. In situ vitrification is a thermal process that destroys combustible and some toxic components of chemical constituents in contaminated soil and immobilizes inorganic and nonvolatile metallic constituents in a durable glass or glass-like crystalline product. With vitrification the soil is heated to temperature of 1,400 to 2,000 degrees centigrade by passing an electric current through electrodes embedded in the contaminated soils, thus producing a molten glass zone to stabilize the contaminants in place. The benefit of this commercially available technology is the permanence of the solution, however, the energy requirements of the process make it a high-cost technology.

Ex Situ Treatment Technologies. The ex situ treatment technologies evaluated in the CMS were biodegradation, encapsulation, solidification and stabilization, soil washing, and thermal desorption. Ex situ biodegradation and solidification and stabilization are fundamentally identical to in situ biodegradation and solidification and stabilization, respectively. The primary difference is that the materials to be treated are excavated before treatment. As a result, worker and environmental exposure to the materials occurs. Ex situ soil washing is a volume-reduction technology that removes contaminants from soils through particle-size separation techniques or by eluting and/or desorbing them into a wash solution. The wash solution is then treated using typical clarification techniques and then recycled. Thermal desorption is a relatively low-temperature (150° to 425° C) thermal-separation process for contaminated soils which is similar to incineration but is directed toward the removal of organics, whereas, incineration is directed toward the destruction of organics. This technology is not an effective treatment for radiologically contaminated soils and full-scale soil remediation has not yet been demonstrated.

Remove/Dispose Alternative. This alternative involves the following elements:

- Remove pipelines and above-ground structures
- Excavate clean overburden material
- Excavate contaminated soils
- Treat contaminated soils if required
- Dispose of contaminated material at the ERDF
- Backfill with clean material, grade, and revegetate the sites.

Under this alternative, contaminated surface soils would be excavated to a depth of 4.6 m (15 ft) below surrounding grade or to the bottom of the engineered structure, whichever is deeper, at the 116-N-1 Crib, 116-N-3 Crib and Trench, and UPR-100-N-31. A 1.5-m (5-ft)-thick layer below the bottom of the 116-N-1 Trench, 116-N-3 Crib, and 116-N-3 Trench is believed to be contaminated with plutonium-239/240. Although the plutonium-239/240-contaminated soils do not currently appear to exceed remedial action goals for protection of groundwater or the Columbia River, plutonium-239/240 represents a very high risk to an individual if exposed through inhalation or ingestion. This contaminated layer would pose an unacceptable risk if the soil were excavated to the depth of this layer in the future; therefore, this layer would be excavated to remove these soils. The removal technology provides the opportunity to characterize and segregate the waste as excavation proceeds, using the observational approach.

Contaminated media (e.g., soil, piping, and demolition waste) excavated from the sites would be transported and disposed at the ERDF in accordance with established waste acceptance criteria. Any material that exceeds the ERDF waste acceptance criteria, which would include RCRA land disposal restrictions, would be stored on the Hanford Site in compliance with ARARs until treated to meet waste acceptance criteria. Soils contaminated with chemicals at levels exceeding waste disposal acceptance criteria (if any) would be treated by solidification/stabilization or other appropriate treatment technology. Solidification and stabilization are treatment technologies designed to reduce contaminant solubility, mobility, or toxicity through chemical or physical changes. Typical solidification and stabilization agents include cement-based materials, clays, asphalt, and resins (e.g., epoxies). Contaminated soil and/or contaminated products resulting from treatment technologies would be disposed of in the same manner as materials that meet the waste acceptance criteria without treatment.

As indicated in the Proposed Plan, the estimated cost for completion of these activities was over $37 million. However, additional characterization of the 116-N-1 and 116-N-3 TSD units was performed subsequent to issuance of the Proposed Plan, which impacted the original cost estimates as documented in the *100-NR-1 Treatment, Storage, and Disposal Units Engineering Study*, BHI-01092. Therefore, the current cost for these activities is estimated at approximately $22 million as shown in Table 3. Waste volumes from which the cost estimates are derived are shown in Table 4. Schedules of RCRA closures originate in the RCRA closure plan and are enforceable through RCRA authority (WAC 173-303-610(3)(a)(viii)). Milestones within the Tri-Party Agreement will be established for remedial actions and TSD closure activities, with the latter reflecting approved TSD unit closure plan schedules. The corrective action schedule of compliance will be the same as the closure schedule. Closure activities (actual cleanup) for the 116-N-3 will begin in July 2000 and, at the completion of 116-N-3 (approximate duration of 15 months), the closure activities at 116-N-1 will begin. The total duration of these activities is approximately 3 years. The expenditures would be spread approximately evenly over the 3-year duration.

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The evaluation and comparative analysis of alternatives that was conducted in the CMS was applicable to the waste sites where action is required. The selected remedy of remove/dispose under the rural-residential exposure scenario is believed to provide the best balance of tradeoffs between the alternatives with respect to the CERCLA evaluation criteria. As part of the CERCLA criteria for compliance with ARARs, the alternatives were evaluated with respect to the RCRA closure and corrective action performance standards (WAC 173-303-610[2][a]). Additionally, in accordance with DOE policy, the alternatives were evaluated against values of

Table 3. Cost Estimate[10] Summary for 116-N-1 and 116-N-3 for the Remove/Dispose Alternative Under a Rural Residential Exposure Scenario.

Item Description	Estimated Cost
Remove concrete panels and beams	$479,819
Demolish and remove high-dose concrete	$113,846
Demolish and remove low-level waste concrete	$25,693
Excavate 116-N-1 Crib	$344,639
Excavate 116-N-1 Trench	$307,364
Excavate 116-N-3 Crib	$230,985
Excavate 116-N-3 Trench	$196,654
Excavate clean overburden -- 116-N-1 Crib and Trench	$36,388
Excavate clean overburden -- 116-N-3 Crib and Trench	$26,792
Backfill	$1,037,209
Site restoration	$36,350
Support functions	$684,918
Mobilization/demobilization	$367,535
Subtotal	$3,888,192
ERDF disposal	$3,775,475
ERC support	$2,320,371
Pipeline removal	$1,967,804
Subtotal	$11,951,842
Engineering/design	$2,570,000
Subtotal	$14,521,842
Direct distributables	$2,679,280
Subtotal	$17,201,121
General and administrative	$629,561
Subtotal	$17,830,682
Contingency (34%)	$4,063,626
TOTAL	**$21,894,309**

[10] Source: *100-NR-1 Treatment, Storage, and Disposal Units Engineering Study*, BHI-01092, Rev. 1, Bechtel Hanford, Inc., Richland, Washington, June 28, 1999.

Table 4. Volume Summary[11] for Cost Estimates

Facility	Bank Volume (ft^3)	Bank Volume (m^3)
116-N-1 Crib	507,500	14,362
116-N-1 Trench	468,125	13,247
116-N-3 Crib	300,000	8,490
116-N-3 Trench	290,625	8,225

the *National Environmental Policy Act of 1969* (NEPA). The remedial alternatives that were evaluated for the 100-NR-1 TSD units and associated sites are the no action and remove/dispose alternatives.

The following is a summary of the comparative analysis of these remedial alternatives that was conducted in the CMS.

Overall Protection

Overall protection of human health and the environment is the primary objective of the remedial action and addresses whether a remedial action provides adequate overall protection of human health and the environment. Alternatives that do not meet this threshold criterion are not valid alternatives.

The no action alternative provides no control of exposure to the contaminants at the waste sites. The remove/dispose alternative would provide protection by eliminating or reducing exposure to the contaminants.

Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs addresses whether or not a remedial action will meet all the applicable or relevant and appropriate requirements and other federal and state environmental statutes or provides grounds for invoking a waiver. This is also a threshold criterion.

ARARs do not apply to the no action alternative since no action would be taken and contaminants would be left in place at concentrations exceeding cleanup standards. The remove/dispose alternative would comply with ARARs (e.g., cleanup standards required under MTCA such as direct soil exposure levels, groundwater and river protection standards [*Clean Water Act*, primary and secondary drinking water standards], and river protection standards [AWQC]) by removing contaminants above cleanup standards from the site and disposing of the contaminants in an engineered disposal facility.

[11] Ibid.

Long-Term Effectiveness and Permanence

This criterion refers to the magnitude of residual risk and the ability of a remedial action to maintain reliable protection of human health and the environment after remedial goals have been met.

The no action alternative would not be effective because it would leave contaminated soils in place above 3 or 4.6 m (10 or 15 ft). Furthermore, neither restoration nor revegetation efforts would be performed under the no action alternative. The remove/dispose alternative would have the greatest long-term effectiveness. It would remove the near-surface contaminated material that has the highest likelihood of causing surface exposure from the site and would place these materials in an engineered disposal facility. The remove/dispose alternative would not require long-term operation and maintenance except for institutional controls.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion refers to an evaluation of the anticipated performance of the treatment technologies that may be employed in the remedy.

The no action alternative would provide no treatment and, thus, provides no reduction in toxicity, mobility, and volume through treatment. The remove/dispose alternative would use a small amount of treatment to reduce the toxicity, mobility, and/or volume by employing solidification/stabilization or other treatment as appropriate to meet ERDF waste acceptance criteria.

For excavated soils, the remove/dispose alternative would reduce contaminant mobility through treatment of soils that contain hazardous waste that do not meet RCRA land disposal restriction standards.

Short-Term Effectiveness

Short-term effectiveness refers to an evaluation of the speed with which the remedy achieves protection. It also refers to any potential adverse effects on human health and the environment during the construction and implementation phases of a remedial action.

The no action alternative would not pose additional risk to the community, the workers, or the environment. The remove/dispose alternative would achieve remedial action objectives relatively quickly, but would pose a risk of release of contaminants and worker exposure during excavation, transport, and redisposal of contaminated media. Remediation activities would need to be carefully planned to minimize the associated risk.

Implementability

Implementability refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selected solution.

The no action alternative would be the most implementable from a technical standpoint because no action would be taken at the site. The remove/dispose alternative would be implementable using proven technologies. Any specific implementation concerns, especially those due to high radiation levels, could be addressed and resolved during remedial design.

Costs

The cost to implement the no action alternative would be negligible. The estimated cost to implement the remove/dispose alternative is nearly $22 million (total present worth). Costs shown in Table 5 use a 7% discount rate and have an accuracy range between +50 and -30%.

Table 5. Cost Estimate Summary for the No Action and Remove/Dispose Alternatives

Alternative	Total Present Worth Cost ($)[1]
No Action	Negligible
Remove/Dispose for 116-N-1, 116-N-3, and UPR-100-N-31	22,894,309

[1]Present worth costs are in 1997 dollars with an accuracy of plus 50% to minus 30%, and do not include escalation. No operation and maintenance costs are associated with these alternatives.

State Acceptance

State acceptance indicates whether, based on its review of the CMS, the Proposed Plan, and the Administrative Record, the state concurs with, opposes, or has no comment on the selected interim remedial action. The State of Washington concurs with the selection of the interim remedial action described in this ROD.

Community Acceptance

Community acceptance refers to support by the public for the preferred remedial action alternative and is assessed following a review of the public comments received on the CMS and the Proposed Plan. On April 2, 1998, a meeting was held to discuss the Proposed Plans for the 100-NR-1 and 100-NR-2 OUs. The results of the public meeting and the public comment period indicate overall general acceptance and support of the preferred remedial alternative. Community response to the remedial alternatives is presented in the Responsiveness Summary in Appendix A, which addresses questions and comments received during the public comment period.

National Environmental Policy Act Evaluation

In accordance with DOE policy, DOE has evaluated the environmental consequences of implementing the remedial alternatives, including potential short-term direct and indirect impacts, have been evaluated in Section 6.0, Detailed Analysis of Alternatives, of the CMS (DOE/RL-96-39, Rev.0). Impacts are expected to be limited to potential exposure of remediation workers to hazardous or radioactive substances, short-term indirect impact to wildlife from construction noise, and disturbance of the land area designated for wells, equipment, and facilities. The cumulative impact of implementing reasonable foreseeable remedial actions is expected to generally improve ecological conditions in the 100 Areas in the long term.

Ecological review of the OUs indicates that the sites to be impacted by the interim remedial action are located within areas previously disturbed by pre-Hanford Site agricultural activities and by previous reactor operations at the Hanford Site. Because of the previous disturbance, ecological or cultural resources are not expected to be significantly impacted by the interim remedial action. However, cultural and natural resource reviews will be conducted before siting activities to determine the potential impacts associated with specific actions. Mitigation measures will include actions to minimize dust, use of protective equipment to minimize dust, use of protective equipment to minimize worker exposures, seasonal scheduling of site work to minimize disturbance to wildlife, archeological monitoring and/or data recovery (as appropriate), and revegetation of the site following interim action.

X. SELECTED REMEDY

Based upon consideration of the requirements of RCRA and CERCLA, the detailed analysis of the alternatives, and public comments, the Tri-Parties have selected the remove/dispose alternative under a rural-residential scenario for the 116-N-1 and 116-N-3 TSD units and the UPR-100-N-31 spill site. They have determined that this remedy achieves the best balance of the CERCLA criteria. The total estimated cost for the components of the selected remedy is \$21,894,309[12].

The preliminary design considerations described in this ROD are for cost estimating and are expected to change based on final design and construction practices. Potential impacts to ecological and cultural resources will be addressed by the development of mitigation plans with input from the Natural Resource Trustee Council to address site-specific ecological resources and the tribal nations to address site-specific cultural resources.

The specific remedial action activities included in the selected remedy are listed below.

116-N-1, 116-N-3, and UPR-100-N-31. The selected remedy for the 116-N-1 and 116-N-3 TSD units and the UPR-100-N-31 spill site includes the following activities:

1. Per the Tri-Party Agreement, DOE is required to submit the remedial design report, remedial action work plan, and sampling and analysis plan as primary documents. These documents and associated documents concerning the planning and implementation of remedial design and remedial action shall be submitted to Ecology for approval prior to

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[12] Source: *100-NR-1 Treatment, Storage, and Disposal Units Engineering Study*, BHI-01092, Rev. 1, Bechtel Hanford, Inc., Richland, Washington, June 28, 1999.

the initiation of remediation. The 100 Area remedial design report and remedial action work plan may be revised as an alternative to submitting new documents. All work required under this approved interim remedial action must be done in accordance with approved plans and ARARs.

2. Prior to beginning remedial action or excavation, a cultural and natural resources review will be conducted.

3. Remove and stockpile any uncontaminated overburden that needs to be moved to gain access to contaminated soils and, to the extent practicable, use this overburden for backfilling excavated areas.

4. The extent of remediation of the waste sites will be as follows:

   a) For remediation of the top 4.6 m (15 ft) below surrounding grade or the bottom of the engineering structure, whichever is deeper, remove until contaminant levels are: (1) demonstrated to be at or below MTCA Method B levels for nonradioactive chemicals, and achieve 15 mrem/year above background for radionuclides for rural residential exposure, and (2) demonstrated to provide protection of the groundwater and the Columbia River. Contaminant levels will be reduced so concentrations reaching the groundwater or the Columbia River do not exceed MTCA Method B levels, federal and state MCLs, or federal and state AWQC, whichever is most restrictive.

   b) For sites where the engineered structure and/or contaminated soil and debris begins above 4.6 m (15 ft) and extends to below 4.6 m (15 ft), the engineered structure (at a minimum) will be remediated to achieve RAOs such that contaminant levels are demonstrated to be at or below MTCA Method B levels for nonradioactive chemicals for exposure and the 15 mrem/yr residential dose level, and are at levels that provide protection of groundwater and the Columbia River. Any residual contamination present below the engineered structure and at a depth greater than 4.6 m (15 ft) shall be subject to several factors in determining the extent of remediation, including reduction in risk by decay of short-lived radionuclides (half-life less than 30.2 years), protection of human health and the environment, remediation costs, sizing of the ERDF, worker safety, presence of ecological and cultural resources, the use of institutional controls, and long-term monitoring costs. The extent of remediation also must ensure that contaminant levels remaining in the soil are at or below MCLs for protection of groundwater or AWQC for protection of the Columbia River. For radionuclides, groundwater and river protection may be demonstrated through a technical evaluation using the computer model RESRAD. The application of the criteria for the balancing factors will be made by EPA and Ecology on a site-by-site basis. A public comment period of no less than 30 days will be required prior to making any determination to invoke balancing factors.

   c) Remove soils to a depth of 1.5 m (5 ft) below the engineered structures of 116-N-1 and 116-N-3 cribs and trenches that contain plutonium-239/240 contaminants.

5. The measurement of contaminant levels during remediation will rely on field screening methods. Appropriate confirmational sampling of field screen measurements will be taken to correlate and validate the field screening. After field screening activities have indicated that cleanup levels have been achieved, a more extensive confirmational sampling program will be undertaken that routinely achieves higher levels of quality assurance and quality control that will support the issuance of an interim remedy CERCLA closeout report for the waste site.

6. After a site has been demonstrated to achieve cleanup levels and RAOs, it will be backfilled and re-vegetated. To the extent practicable, removed and stockpiled uncontaminated overburden will be used for backfilling of excavated areas. Re-vegetation plans will be developed as part of remedial design activities. Efforts will be made to avoid or minimize impacts to natural resources during remedial activities, and the Natural Resources Trustees and Native American Tribes will be consulted during mitigation and restoration activities.

7. Pipelines associated with the units will be removed and disposed or sampled to determine if they meet remedial action objectives and can be left in place.

8. Treatment of excavated soils will be conducted before disposal, as required, to meet RCRA land disposal restrictions and the ERDF waste acceptance criteria.

9. Excavated contaminated soils, structures, and pipelines will be transported to the ERDF for disposal. Excavation activities will follow all appropriate construction practices for excavation and transportation of hazardous materials and will follow as low as reasonably achievable (ALARA) practices for remediation workers. Dust suppression during excavation, transportation, and disposal will be implemented as necessary.

10. Post-remediation monitoring of the vadose zone and groundwater will be performed to confirm the effectiveness of remediation efforts and accuracy of modeling predictions associated with the selected remedy.

11. Institutional controls and long-term monitoring will be required for sites where wastes are left in place and preclude an unrestricted land use. Institutional controls selected as part of this remedy are designed to be consistent with the interim action nature of this ROD. Additional measures may be necessary to ensure long-term viability of institutional controls if the final remedial actions selected for the 100 Area does not allow for unrestricted land use. Any additional controls will be specified as part of the final remedy. The following institutional controls are required as part of this interim action:

   a) DOE will continue to use a badging program and control access to the sites associated with this ROD for the duration of the interim action. Visitors entering any of the sites associated with this Interim Action ROD are required to be escorted at all times.

b) DOE will utilize the on-site excavation permit process to control land use well drilling and excavation of soil within the 100 Area OUs to prohibit any drilling or excavation except as approved by Ecology.

c) DOE will maintain existing signs prohibiting public access.

d) DOE will provide notification to Ecology upon discovery of any trespass incidents.

e) Trespass incidents will be reported to the Benton County Sheriff's Office for investigation and evaluation for possible prosecution.

f) DOE will take the necessary precautions to add access restriction language to any land transfer, sale, or lease of property that the U.S. Government considers appropriate while institutional controls are compulsory, and Ecology will have to approve any access restrictions prior to transfer, sale, or lease.

g) Until final remedy selection, DOE shall not delete or terminate any institutional control requirement established in this Interim Action ROD unless Ecology have provided written concurrence on the deletion or termination and appropriate documentation has been placed in the Administrative Record.

h) DOE will evaluate the implementation and effectiveness of institutional controls for the 100-NR-1 OUs on an annual basis. The DOE shall submit a report to Ecology by July 31 of each year summarizing the results of the evaluation for the preceding calendar year. At a minimum, the report shall contain an evaluation of whether or not the institutional control requirements continue to be met and a description of any deficiencies discovered and measures taken to correct problems.

12. Because this is an interim action and wastes will continue to be present in the 100 Area until such time as a final ROD is issued and final remediation objectives are achieved, a five (5)-year review will be required.

The remediation standards for the selected remedial actions have been based on the rural-residential scenario so as to not preclude any future land use. Remedial action objectives and cleanup standards will be reevaluated if future land-use and groundwater-use determinations are inconsistent with the selected remedial action.

XI. STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, comply with ARARs, be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, CERCLA includes a preference for remedies that employ treatment that significantly and permanently reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. This section discusses how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment. The selected remedy protects human health and the environment through removal and disposal of contaminated soils, structures, and debris that pose an unacceptable risk to human health and the environment under assumed future land-use scenarios. Implementation of this interim remedial action will not pose unacceptable short-term risks to site workers that cannot be mitigated through standard remediation practices.

The QRA for a frequent-use (rural-residential) exposure scenario associated with waste sites under this interim remedial action estimated increased cancer risks greater than 1×10^{-2} for waste sites 116-N-1 and 116-N-3. Remediation of waste sites 116-N-1 and 116-N-3 will principally occur to remove contaminated soils, structures, and debris. The residual increased cancer risks after implementation of this remedy are estimated at 3×10^{-4} for exposure to radionuclides. For individual nonradioactive chemicals, the residual increased cancer risks are expected to be less than or equal to 1×10^{-6}, and the cumulative increased cancer risks for nonradioactive chemicals are expected to be less than or equal to 1×10^{-5}.

Residual Risks Post-Achievement of RAOs. Residual risks after meeting RAOs were estimated based on a rural-residential land-use scenario for soils. Site risks from contaminated soils, structures, and debris with respect to nonradioactive chemicals are reduced from greater than 1×10^{-2} to approximately 1×10^{-5}, representing a 99.9% reduction in risk. Site risks from contaminated soils, structures, and debris with respect to radionuclides are reduced from greater than 1×10^{-2} to at least 3×10^{-4}, representing a 97% reduction in risk.

Compliance with ARARs. The selected remedy will comply with the federal and state ARARs identified below. No waiver of any ARAR is being sought. The ARARs identified for the 100-NR-1 TSD units and their associated sites are the following.

- *Model Toxics Control Act* (MTCA) (70.105D *Revised Code of Washington* [RCW]), "MTCA Cleanup Regulation" (WAC 173-340). Establishes risk-based cleanup levels that are applicable for establishing cleanup levels for metal and organic contaminants in soil, structures, and debris.

- *Safe Drinking Water Act of 1974* (SDWA) (40 U.S.C. 300, et seq.), "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* [CFR] 141). Establish MCLs for public drinking water supplies that are relevant and appropriate for establishing soil cleanup goals that are protective of groundwater.

- *Federal Water Pollution Control Act of 1977* (33 U.S.C. 1251, et seq.), "Water Quality Standards" (40 CFR 131). Establishes AWQC that are relevant and appropriate for establishing soil cleanup goals that are protective of the Columbia River.

- "Water Quality Standards for Surface Waters of the State of Washington" (WAC 173-201A). Establishes surface water quality criteria that are relevant and appropriate for establishing soil cleanup goals that are protective of the Columbia River.

- *Hazardous Waste Management Act of 1976* (70.105 RCW), "Dangerous Waste Regulations" (WAC 173-303). This RCRA-authorized state program is applicable to the identification and generation of dangerous waste (which includes all federally regulated hazardous waste under RCRA) and storage, transportation, treatment, and disposal of the wastes generated during the interim remedial action that designate as dangerous waste.

- "Closure and Postclosure" (WAC 173-303-610[2]). RCRA closure and postclosure performance standards are applicable for the closure of the TSD units.

- "RCRA Land Disposal Restrictions" (40 CFR 268). Applicable for treatment and disposal of wastes designated as dangerous wastes.

- "RCRA Standards for Miscellaneous Treatment Units" (40 CFR 264, Subpart X). Relevant and appropriate to the construction, operation, maintenance, and closure of any miscellaneous treatment unit constructed in the 100 Areas for treatment of dangerous wastes.

- *Solid Waste Management Act* (70.95 RCW), "Minimum Functional Standards for Solid Waste Handling" (WAC 173-304). Applicable for management of solid wastes generated during the interim remedial action.

- *Toxic Substances Control Act* (15 U.S.C. 2601, et seq.) implemented via 40 CFR 761. Applicable to the management and disposal of remediation waste containing regulated concentrations of polychlorinated biphenyls (PCBs), including specific requirements for PCB remediation waste.

- "Requirements for Land Disposal of Radioactive Wastes" (10 CFR 61). Establishes requirements for management and disposal of radioactive waste at U.S. Nuclear Regulatory Commission-licensed facilities that are relevant and appropriate for wastes generated by the interim remedial action.

- *Clean Air Act* (42 U.S.C. 7401, et seq.) and "National Emissions Standards for Hazardous Air Pollutants" (40 CFR 61). Applicable to remedial activities that will result in airborne emissions of hazardous air pollutants, including prohibitions on radionuclide emissions that would result in an effective offsite dose equivalent of 10 mrem/yr and visible emissions from asbestos-handling activities.

- "Emission Limits for Radionuclides" (WAC 173-480). Applicable to remedial activities that will result in air emissions of radionuclides from specific sources, including requirement for best available radionuclide control technology (BARCT).

- *Nuclear Energy and Radiation Act* (70.98 RCW) and "Radiation Protection -- Air Emissions" (WAC 246-247). Applicable to remedial activities that will result in airborne emissions of radionuclides, including prohibition on radionuclide emissions that would result in an effective offsite dose equivalent of 10 mrem/yr and requirements for monitoring, as appropriate.

- "Minimum Standards for Construction and Maintenance of Wells" (WAC 173-160). Applicable for the location, design, construction, and abandonment of water supply and resource protection (including monitoring) wells.

- *National Archeological and Historical Preservation Act of 1974* (26 U.S.C. 469) implemented via 36 CFR 65. Applicable when remedial activities may cause irreparable harm, loss, or destruction of significant artifacts in the 100-N Area.

- *Archeological Resources Protection Act of 1979* (16 U.S.C. 417) implemented via 43 CFR 7. Applicable when remedial activities may cause possible harm or destruction of sites in the 100-N Area having religious or cultural significance.

- *National Historic Preservation Act of 1966* (16 U.S.C. 470, et. seq.) implemented via 36 CFR 800. Applicable to remedial activities that could impact historic or potentially historic properties.

- *Endangered Species Act of 1973* (16 U.S.C. 1531, et. seq.) implemented via 50 CFR 17, 22, 200, 225, 226, 227, 402, and 424. Applicable to remedial activities that could impact threatened or endangered species or critical habitat upon which endangered or threatened species depend.

- "Habitat Buffer Zone for Bald Eagle Rules" (77.12.655 RCW) and WAC 232-12-292. Applicable if the areas of remedial activities include bald eagle habitat.

- *Hanford Reach Study Act* (Public Law 100-605). Applicable to remedial activities that could result in any direct and adverse impacts to the Columbia River. Consultation with the U.S. National Park Service is required.

Other Criteria, Advisories, or Guidance to be Considered for this Interim Remedial Action (TBCs)

- *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00319, Rev. 3. Delineates primary requirements including regulatory requirements, specific isotopic constituents and contamination levels, the dangerous/hazardous constituents and concentrations, and the physical/chemical waste characteristics that are acceptable for disposal of wastes at the ERDF.

- The Future for Hanford: Uses and Cleanup, The Final Report of the Hanford Future Site Uses Working Group, December 1992. Provides stakeholder input on potential future land uses of the 100 Area.

- *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement,* DOE/EIS-0222-F, September 1999. Provides DOE's land-use determination for the Hanford Site.

Cost Effectiveness. The selected remedy provides overall effectiveness proportional to its cost. The use of the Observational Approach will ensure that a protective remedy is implemented, while saving both time and money by reducing the level of characterization required before remediation can be implemented.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Possible. EPA, Ecology, and DOE have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the 100-N Area TSD units and associated units for the scope of this interim action. Of those alternatives evaluated in the CMS, only the selective alternative is deemed protective of human health and the environment and complies with ARARs. EPA, Ecology, and DOE have determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost. The statutory preference for treatment as a principal element and state and community acceptance are also considered.

Specifically the selected remedies for the 116-N-1, 116-N-3, and UPR-100-N-31 sites are deemed to be the best remedies for these sites for their ability to protect human health and the environment and to provide long-term effectiveness. The no action alternative would fail to control exposure to the contaminants at the waste sites. Under the rural-residential scenario, soils that exceed 15 mrem/yr above natural background for radionuclides and MTCA Method B cleanup values to a depth of 4.6 m below surrounding grade or to the bottom of the engineered structure, whichever is deeper, will be excavated. In addition, the 1.5-m-thick layer below the engineered structure of 116-N-1 and 116-N-3 that contains plutonium-239/240 would be removed. The plutonium-contaminated soils do not appear to exceed remedial action goals for the protection of groundwater or the Columbia River; however, the plutonium-239/240 represents a very high risk to an individual if exposed through inhalation or ingestion. Because of the plutonium-239/240 contamination, the longevity of plutonium-239/240, and modeling uncertainties, removal of contaminated soils in the concentrated layer to a depth not expected to exceed 1.5 m below the engineering structure is deemed a prudent measure.

Preference for Treatment as a Principal Element. The selected remedy may involve treatment of some portion of the excavated soils in order to meet ERDF waste acceptance criteria. Additionally, the decay of short-lived radionuclide contaminants disposed of in the ERDF will reduce the toxicity of the waste over time. Because the selected action does not constitute a final remedy for the entire 100-NR-1 OU, the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element will be addressed in a future response action for any contamination remaining within the OU.

Onsite Determination

The preamble to the National Contingency Plan states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The waste sites in the 100-NR-1 OU addressed by this interim action ROD and the ERDF are reasonably close to one another and are considered to be a single site.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

In the Proposed Plan, the Tri-Parties identified a preferred remedy for the 120-N-1 Percolation Pond, the 120-N-2 Surface Impoundment, and the 100-N-58 South Settling Pond. This remedy included removal of liners, structures, and pipelines, followed by backfilling, regrading, and revegetation of these sites. The Proposed Plan noted that sampling at these sites indicated that no soil contamination was present at these sites. As a consequence, these sites are not included in this ROD.

EPA, Ecology, and DOE reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the selected remedy, as originally identified in the Proposed Plan, were necessary.

APPENDIX A

RESPONSIVENESS SUMMARY

PUBLIC COMMENT RESPONSES
100-N AREA DECISION DOCUMENTS

I. Responsiveness Summary Overview

The Hanford Site was established in 1943 to produce plutonium for nuclear weapons. It is situated north and west of the cities of Richland, Kennewick, and Pasco, Washington. Land use in the areas surrounding the Hanford Site includes urban and industrial development, irrigated and dry-land farming, grazing, and designated wildlife refuges. Operations at the Hanford Site are currently focused on environmental cleanup and waste management.

The 100 Area, which encompasses approximately 68 km^2 (26 mi^2) bordering the south shore of the Columbia River, is the site of nine retired plutonium production reactors. The waste sites being considered for remediation in this ROD are all within the 100-N Area. The 100-N Area is being remediated under the authority of two RODs. The 100-NR-1/100NR-2 ROD addresses RCRA past-practice waste sites, unplanned releases, spills, and associated piping in the 100-NR-1 OU, and the underlying groundwater, designated as the 100-NR-2 OU. This ROD, the 100-NR-1 TSD ROD, addresses two (2) TSD units in the 100-N Area and an unplanned release site.

The 100-NR-1 OU encompasses an area of approximately 405 hectares (1,000 acres). Reactor operations and former waste-handling practices caused contamination in the soil around the N reactor, the HGP, and the adjacent support facilities. The 100-NR-1 OU encompasses all the soil waste sites including the associated structures and pipelines in the 100-N Area.

One hundred fourteen (114) sites in the 100-NR-1 OU were identified as potentially contaminated source waste sites. Thirty-three (33) of the 114 sites were not considered for further action because they were never contaminated or are not currently contaminated, or they will be remediated through another action. Eighty-one (81) sites remain to be remediated under the 100-NR-1/100-NR-2 ROD.

II. Background on Community Involvement and Concerns

The public has been involved in the cleanup of the Hanford Site since the *Hanford Facility Agreement and Consent Order* was signed in 1989. Since 1989, a number of stakeholder working groups and task forces have been used to enhance decision making at the Hanford Site. In January 1994, the Hanford Advisory Board was formed to provide informed advice to DOE, EPA, and Ecology. To date, the board has issued over ninety pieces of advice, several of which directly relate to 100 Area cleanup.

A consistent message from interested citizens and affected Indian Nations is to get on with cleanup and protect the Columbia River.

III. Summary of Major Questions and Comments Received During the Public Comment Period and the Agency Response to Those Comments

Comments received during the public comment period are presented in this section. Responses to the comments follow each comment. Copies of all comment letters and Ecology's response are located in the Administrative Record.

Hanford Generating Plant, ENERGY NORTHWEST General Comments

1. **Comment:** Based on the HGP site's location, Energy Northwest believes that the selection of a rural residential cleanup level is not warranted.

   Response: The selection of the rural residential cleanup level reflects precedence set in the remediation of the 100-BC-1, 100-DR-1, and 100-HR-1 liquid effluent waste sites. The Record of Decision for these remediation actions states 'for the purposes of this interim action, the remedial action objectives are for "unrestricted use".

2. **Comment: Energy Northwest**, as a fiscally responsible municipal corporation of the State of Washington, wants to minimize any undue burden on our customers. Therefore, it is in our best interest to immediately proceed with D&D as necessary to restore the HGP site. The resources are available and we intend to proceed at a quicker rate than proposed by 100 Area remediation schedule.

   Response: The proposed schedule identified in the *Engineering Evaluation/Cost Analysis for the 100-N Area Ancillary Facilities and Integration Plan* is a duration-only schedule, which does not include specific start or end dates, and is intended to indicate the relative priority and critical path of cleanup activities. Specifically, the schedule was established taking into consideration the priority of remediation activities, while ensuring that interference between facility decontamination and demolition and waste site remediation is minimized. Another consideration was to develop a schedule with a relatively even distribution of funding. However, as funding availability fluctuates, the schedule can be delayed or accelerated accordingly within the ten-year time frame.

3. **Comment:** The proposed schedule should provide the flexibility to permit immediate completion of the restoration work at HGP.

   Response: See response to General Comment 2 under Hanford Generating Plant, Energy Northwest General Comments.

Hanford Generating Plant, Energy Northwest Specific Comments

A. *Engineering Evaluation Cost Analysis for the 100-N Area Ancillary Facilities and Integration Plan*, DOE/RL-97-22, Rev. 1.

1. **Comment:** Page 1-2, Line 11: Energy Northwest would like to follow its own schedule to complete work earlier than scheduled. This EE/CA should allow Energy Northwest to fund and contract for cleanup, decontamination, and demolition to a selected contractor of our own selection in accordance with our procedures as long as the cleanup, etc. meets the technical requirements of this EE/CA.

   Response: See response to General Comment 2 under Hanford Generating Plant, Energy Northwest General Comments.

2. **Comment:** Page 2-9: In the first bullet, it is on the northwest wall.

   Response: Comment noted. The word *wall* was omitted from the description.

3. **Comment:** Page 2-15: The physical description for 181-NE is incorrect. The facility houses four circulating pumps and their respective lubricating water pumps in addition to the three fire protection pumps.

   Response: Comment noted. The physical description for 181-NE should state that it houses four circulating pumps and their respective lubricating water pumps in addition to the three fire protection pumps.

4. **Comment:** Page 2-16: There is no 1605-NE Observation Post at HGP. Also see Figure 2-1.

   Response: At the time the EE/CA was prepared, available information indicated the existence of a 1605-NE observation post. The NE designation references facilities associated with the Hanford Generating Plant, which is managed by Energy Northwest. A subsequent investigation has indicated that the facility is located in the 100-N Area, not within the boundaries of the Hanford Generating Plant, and is managed and controlled by the Project Hanford Management Contractor.

5. **Comment:** Page 3-1: In third paragraph, it should be clarified that areas inside the HGP fence do not interfere with any other cleanup operations.

   Response: Comment noted. The areas inside the HGP fence do not interfere with any other cleanup operations.

6. **Comment:** Pages A-6, 7: The availability of basic utilities is essential to keep demolition costs under control. However, we are already addressing the loss of power to

HGP and there is no potable water or sewer system. In addition, the rail lines should be maintained for demolition. The large transformers are normally moved by rail.

Response: Comment noted. As stated in the EE/CA, if there is no justification for keeping services functional, they should be removed. Therefore, the proposed actions provides flexibility to keep rail lines in operation as long as justified.

7. **Comment:** Appendix C: The cost estimates were based on a model that Energy Northwest has already shown to be unreliable for our work.

Response: An EE/CA is a document that assesses the various remediation alternatives of a collection of facilities or remediation units. In order to effectively compare one alternative to another, it is most helpful if the alternative estimates are developed using the same estimating methodology. This allows for an equitable comparison of alternative actions without concern over the use of differing estimating tools. Because the MCACES models have been approved by the DOE for out year baseline estimates, MCACES was applied to the 100-N Area EE/CA facilities as the estimating tool. MCACES meets the U.S. Environmental Protection Agency's guidance for accuracy of cost estimates, which states that typically "study estimate" costs are expected to provide an accuracy of +50 percent to -30 percent and are prepared using available data. During the remedial design, and when additional information becomes available, the cost estimates will be refined.

B. *Corrective Measures Study for the 100-NR-1 and 100-NR-2 Operable Units, DOE/RL-95-111, Rev. 0*

1. **Comment:** Page 1-2, line 15: Please note that the BPA Substation and transmission lines are still in service with no intent to demolish.

Response: Comment noted. As stated on page 2-4, facilities to remain active are not addressed in this EE/CA. Appendix B Table B-2 identifies the BPA Substation as an active facility. Therefore, the BPA Substation is not addressed for removal in this EE/CA.

2. **Comment:** Page 3-75: We believe item 37 is a transformer oil spill and not a dump site. See also Table 3-7.

Response: A review of the Waste Identification Data System (WIDS) listing report for the site in question (100-N-39) has indicated the site was a dumping area. The WIDS report references a Bonneville Power Administration memorandum (1981) that states that the site was used as a dump for construction debris. There is another site identified in WIDS, UPR-100-N-37, which was an unplanned release of transformer oil. The CMS addresses both 100-N-39 and UPR-100-N-37.

3. **Comment:** Page 3-83: In item 10 the facility in the third column should be 1701-NE.

Response: Comment noted. The building listed (1710-NE) should be 1701-NE.

4. **Comment:** Page 3-93: The concrete and soil below the steam line trestle drains should also be listed.

   Response: Waste sites listed in the CMS were obtained from the Waste Identification Data System (WIDS). WIDS is the official database recognized by the Tri-Parties containing information on all identified waste sites at Hanford. The concrete and soil below the stream line trestle were not included in the WIDS system during preparation of the CMS. However, an evaluation of the site will be made to determine appropriateness for inclusion in WIDS. If the site is added to WIDS, it will be addressed in accordance with the applicable action memorandum or record of decision.

5. **Comment:** Page 9-6, 9.2.4: The schedule should be flexible for Energy Northwest HGP activities.

   Response: See response to General Comment 2 under Hanford Generating Plant, Energy Northwest General Comments.

6. **Comment:** Page 9-6: Energy Northwest will meet the training requirements with our own program.

   Response: All DOE-RL and DOE-RL contractor personnel working at the Hanford Site, including at sites associated with the 100-NR-1 Operable Unit, will be provided with and will successfully complete general site training as specified in Condition II.C.2 of the Hanford Facility Dangerous Waste Permit. Personnel working at the Hanford Generating Plant, which is operated by Energy Northwest, will be trained in accordance with Energy Northwest training programs.

<u>Geosafe Comments</u>

A. *100-NR-1 Treatment, Storage and Disposal Units Corrective Measures Study/Closure Plan,* DOE/RL-96-39, Rev. 0.

1. **Comment:** The in situ vitrification (ISV) discussion should include a brief discussion of past ISV work performed at Hanford. Performance information regarding ISV's treatment effectiveness for plutonium, strontium and cesium should also be discussed.

   Response: In situ vitrification was included as a component in four of the alternatives that were evaluated in the screening process described in Section 5.2. The purpose of the assessment in Section 5.1 is to make a qualitative evaluation of effectiveness, implementability, and cost of potentially useful technologies. The qualitative evaluation against these factors relied on a variety of information, including the performance of in situ vitrification methodologies employed at Hanford. The in situ vitrification technology was carried forward for further evaluation, implying that the technology was considered potentially beneficial for remediating the sites under consideration, which could include treatment for plutonium, strontium, and cesium.

2. **Comment:** The discussion on the presence of excessive moisture effecting ISV treatment cost is irrelevant and should be removed. This is true only if there is a substantial amount of groundwater moving into the treatment zone. Note in Figure 2-2 and 2-3, the groundwater elevation is approximately 60 and 70-ft below grade and would not be an issue.

Response: The discussion regarding the effect of moisture on the technology (Section 5.1.4.4) is provided in the context of discussing some of the advantages and disadvantages of the technology. The fact that the technology was carried forward for further evaluation implies that excessive moisture was not considered a factor in selecting remediation alternatives at these sites.

3. **Comment:** The discussion should include some mention of the added benefits resulting from vitrification such as: the product will exhibit no hazardous characteristic and should easily pass TCLP testing, the vitrified product has an extremely low leaching rate-even if ground to a fine powder and inundated in water and the vitrified product is expected to have a geologic life expectancy substantially greater than 10,000 years.

Response: Chapter 6 discusses the implementation of the in situ vitrification technology and how it would be implemented under four different alternatives. In two of the cases, in situ vitrification was rejected because of the potential for intrusion into the vitrified monolith, and the third case it was rejected because of depth limitations of the technology. In the fourth case, in situ vitrification was retained for detailed evaluation. During the detailed evaluation of alternatives, in situ vitrification was rejected because it had a higher cost of implementation than that of the preferred option (remove/dispose). The durability of the vitrified product was never called into question.

B. *Proposed Plan for Interim Remedial Action and Dangerous Waste Modified Closure of the TSD Units Associated Sites in 100-NR-1 Operable Unit*, DOE/RL-97-30, Rev. 0

1. **Comment:** Given the high concentration of radionuclides in the 116-N-1 and N-3 Cribs and Trenches, a discussion should be provided on how this material will meet the ERDF waste acceptance criteria (WAC). I assume the waste is not being diluted to meet the WAC requirements. A table showing the WAC criteria versus available characterization information from the subject units should be included.

Response: Clean or slightly contaminated soil would be added to the high contamination soil fraction for the purpose of controlling radiation exposure to workers and to meet some operational limitations at ERDF concerning ambient air quality. The need to blend the soil is not related to the ERDF WAC.

2. **Comment:** Given that plutonium concentrations greater than 100 nCi/g are considered to be a TRU regulated waste, some discussion should be provided on the TRU components of the waste being shipped to ERDF.

Response: There are a few samples that showed localized plutonium concentrations in excess of 100 nCi/g, but the contaminated soil in the cribs and trenches, taken in aggregate and without addition of any other soil, is expected to be significantly below the 100 nCi/g threshold. The radionuclide content will be verified by sampling that will be done during the remedial design phase.

3. **Comment:** Given that the proposed plan is selected for implantation the 116-N-1 and 116-N-3 units will still require institutional controls for the radionuclide plume that will be left in place; thus elimination of purely in situ treatment options for similar reasoning does not seem to be justified or logical. Additional discussion on why in situ treatment alternatives have not been evaluated should be provided.

   Response: Under the preferred option (remove/dispose), radionuclide contamination will be removed to a depth of at least 15 ft, thereby reducing the potential for exposure from near-surface intrusion. In contrast, the vitrification alternative would result in radionuclide contaminants remaining in relatively close proximity to the ground surface (and to potential intruders).

Comments by an Individual

1. **Comment:** In evaluating a number of Hanford Annual environmental reports it appears for 1996 the dose from Strontium-90 was .-18 mrem per year. Which equated to 126 person mrems for the Tri-Cities. The government is spending $1,374,000,000,000.00 per mrem reduction (i.e., .062 Ci/yr flux reduction) or about 20 million dollars per person mrem reduction. Are these costs per mrem or person mrem reduction justified? In my review of cost benefit ALARA Analysis – number of ten thousand dollars per mrem reduction is what I remember being justified. Please provide references to dose reductions that justify this level of spending for such a small dose reduction.

   Response: There are no specific references to dose reductions to justify this level of expenditure. The concentrations of Strontium-90 in the groundwater reaching the Columbia River (which is a point of compliance) are 1000 to 2000 times the Maximum Concentration Level (8 picoCuries/L) allowed by law. Upon reaching the Columbia River, the incoming Strontium-90 is diluted by the Columbia River to levels which are below the MCL. However, because the groundwater at the river's edge is above the MCL, the DOE is required by law to address this problem. The DOE can achieve this requirement by either a remedial action that will clean-up the site to below the MCL's or by setting an alternative concentration limit (ACL). The ACL can only be set after demonstrating that it is impracticable to remediate the site. The present pump-and-treat is scheduled to last five years, and is part of a process to determine the practicability of remediating the site.

2. **Comment:** Page 2-3, 120-N-1 and 120-N-2 TSDs: Respectfully request Ecology delete TSDs 120-N-1 and 120-N-2 from this continued monitoring as a modified RCRA/CERCLA closure plan and provide a plan that is reflective of the current conditions of clean closure of TSD sites 120-N-1 and 120-N-2. Ecology and DOE

provide only an inventory of acid or caustic liquids that were deposited at these sites. The documentation says nothing was detected in the soil samples -- therefore the site is clean. No elevated sulfate observed in the groundwater are probably the result of discharging Sulfuric Acid and is not of major concern or major health problem for the concentration observed. The water will still meet general house hold and irrigation uses (Davis and DeWiest, Hydrogeology). The elevated Sulfate will only provide odor or taste that is not harmful. I respectfully requested that the money currently being spent on RCRA groundwater monitoring of 120-N-1 and 2 be refocused to something more constructive like removing 1500 drums of uranium and oil in the 300 Area.

Response: While the 120-N-1 and 120-N-2 TSD units are subject to RCRA closure requirements, the groundwater underlying these units is currently being monitored as part of the on-going CERCLA program. The current groundwater monitoring regimen will be followed until a final action for groundwater remediation is determined. The proposed plan for continued groundwater monitoring does not call for the expenditure of any additional resources than are currently being expended to meet CERCLA monitoring requirements.

3. **Comment:** Page 2-3, 116-N-1, 116-N-3, and UPR-100-N-31. As is provided in DOE/RL-96-39 the modeling performed indicates that Strontium-90 will not significantly reach the Columbia River. And as was provided in earlier analysis more remediation of Strontium-90 occurs through natural attenuation than through pump and treat systems (i.e., .1 Ci remove from pump and treat and 2.2 Ci from natural attenuation- decay). The natural attenuation provides 96% of the Strontium-90 remediation in the 100-N Area -- Ecology and DOE need to explain why such efforts are being taken to expend such monetary resources for such little return of 5% of the Strontium-90 – it will still take 270-300 years potentially to remediate this site with either of these two technologies? Respectfully request the cessation of the 100 N Area expenditure on pump and treat of $1,000,000 per year and refocus the money on solving the 200 Area Carbon tetrachloride plume which is of real concern as demonstrated in BHI's model predictions of contaminant plumes (BHI-00608 and BHI-00469) and is observed by the rate of spending in the Annual groundwater reports (i.e., 1997, 1996, 1995, 1994). With the current pump and treat and further analysis there appears to b a 2.55 Ci per year contribution to the Columbia River as calculated from the 1996 average Strontium-90 in the Columbia River and average flow of 4500 cubic meters per second (Table Annual average Sr-90 Dose) and not the claimed .063 Ci/yr flux. Request Ecology reconcile these differences in Flux.

Response: It is unclear what the commentor's calculation of 2.55 Ci/yr represents. However, this number appears to be the average number of curies/year in the Columbia River. The 0.063 Ci/year is calculated by taking the concentrations of groundwater at the river shore and multiplying the concentration by the total flux of water discharging through the contaminated zone into the river for each year. It is agreed that the current pump-and-treat system will not significantly reduce the clean-up time over natural attenuation. The purpose of the current pump-and-treat system is to accomplish the following:

- remove Sr-90 from the groundwater,
- reduce the flow of water through the aquifer (by reducing the flow of water, it also reduces the amount of Sr-90 being released to the river), and
- collect data for either additional remedial alternatives and/or help set an alternative concentration limit for this site.

4. **Comment:** Provide the cost estimate for the Barrier Wall – Passive Remedial action. The earlier analyses are missing from these current document. Ecology's earlier estimate demonstrate pump and treat cost approximately $300,000,000 more than the Barrier Wall which makes pump and treat less effective.

   Response: The estimated cost of a permeable reactive barrier is $28,000,000 (DOE/RL-96-11). However, a constructibility test for installation of an impermeable barrier showed that the required sheet pile could not be installed using drive techniques.

5. **Comment:** The current approach of putting out these four documents (DOE/RL-96-102, DOE/RL-97-30, DOE-RL-96-30, and DOE/RL-95-111) is very confusing. Request Ecology and DOE provide one single document that provide a clear plan for Remedial Actions for 100 N Area. It is very unclear what was evaluate and against what to determine what is the right approach to remediate groundwater at 100 N Area. In reviewing these documents it appears previous analysis are not now considered. Please provide the detail written analysis that has lead Ecology to recommended alternative on continued pump and treat.

   Response: With regard to the approach for publishing documents for the 100-N Area remedial actions, it should be noted that both the RCRA and CERCLA regulatory processes require a detailed evaluation of alternatives in the form of a corrective measures study (RCRA) or a feasibility study (CERCLA). The alternatives recommended as a result of these studies are presented to the public in a proposed permit modification (RCRA) or a proposed plan (CERCLA). In order to provide the public with convenient access to the greatest amount of information and to minimize the expense of producing both RCRA and CERCLA documents for proposed actions in the 100-N Area, the RCRA and CERCLA procedural requirements were integrated. The proposed plans, along with the appropriate corrective measures studies, were issued to meet the RCRA and CERCLA requirements. Each of the proposed plan documents is accompanied by a summary that describes the integration of RCRA and CERCLA requirements and discusses other actions that are underway or planned in the 100-N Area. In addition, the issuance of these documents meets two milestones established by the Tri-Party Agreement: M-15-12B required documentation to cover the TSD units and M-15-12C required coverage of the 100-NR-1 and 100-NR-2 source units.

   With regard to the analysis associated with continuing the pump-and-treat operations, the current pump-and-treat system is part of Emergency Remedial Action installed in 1995. It is not the final remedy. Data collected during the operation of the pump-and-treat will be used to select the final remedy. That final remedy will also solicit public comments. At present, it is very difficult to remove Strontium-90 adsorbed onto the sediments. As long as Sr-90 adsorbed onto the sediments is in contact with the groundwater, the concentrations in the groundwater will exceed the maximum concentration limit by three orders of magnitude. This is due to the chemical equilibrium between the Strontium-90 on the sediments and in the groundwater.

Comments by an Individual

1. **Comment:** As a taxpayer I am concerned that excessive amount of money would be proposed to be spent cleaning up a single site along the river to pristine conditions when I cannot foresee the future need of the public to utilize this specific small area for agricultural or residential use. Even if the 100 N Area is "cleaned UP", these is no sampling protocol which can guarantee the public that it is clean and safe to habitate with no risk. The same applies to the entire Hanford Site. Which I am not knowledgeable about the treaty rights of the tribes, nor the specifics of the MTCA, I feel recreational/industrial use is a reasonable alternative, which adequately reduces the dose to the public, removes the bulk of the source term from near the river, and doesn't cost an exorbitant amount of money.

   Response: See response to General Comment 1 under the HGP comments.

Nez Perce Comments

1. **Comment:** It is difficult to ascertain the impact of these actions upon our people as none of the Native American Scenarios outlined in the Columbia River Comprehensive Impact Assessment (CRCIA) were assessed.

   Response: The future land use for the Hanford Site has not yet been determined under this interim action. To provide a basis for evaluating the various remediation technologies, two land-use scenarios were used. One reflects a conservative approach in which the land would be used extensively (i.e., rural residential) and the other reflects a less conservative approach in which the land would be used in a less intensive way (i.e., ranger/industrial). Once the land use for the entire Hanford site has been determined, past and future actions throughout the site will be assessed to ensure consistency with the intended use.

2. **Comment:** Chromium contamination of the 100-N Area is not being addressed. During Fiscal Year 1968, N reactor operations consumed more than 15,000 lb. of Sodium Dichromate (**Chemical Discharged to the Columbia River from DUN Facilities, Fiscal Year 1968** DUN_4668). Chromium concentrations in groundwater samples from Well 199-N-80 are consistently above drinking water standards of 50 ug/L, but remediation of chromium in groundwater is postponed until the final remedial action.

   Response: Well 199-N-80 was drilled and completed in 1992 to RCRA well standards and is completed in a confined sand unit. This confined sand unit is about 15 ft below the upper unconfined aquifer and is separated from it by a clay layer (Hartman and Lindsey 1993). The chromium values at 199-N-80 are above the drinking water standard (50

1g/L) and above the values determined for the upper unconfined aquifer. The upper unconfined aquifer contains the groundwater that can be directly influenced by discharge from the 100-N Facilities (1324N/NA, 1301-N and 1325-N) and other surface activities. The only other well that may be screened in the same unit as 199-N-80 is well 199-N-8P. This is a piezometer located within 50 to 75 ft of the river. Samples are collected from this piezometer on an irregular basis. Chromium was not detected in a sample from 199-N-8P collected in April 1992. It is also important to note that wells screened in the uppermost unconfined aquifer (199-N-75), in the bottom of the unconfined aquifer (199-N-69) and adjacent to the river (199-N-8T, 199-N-8S), all within the general Arial location of well 199-N-80 do not have chromium values above the drinking water standard. The chromium values at well 199-N-80 appear to be well-specific and not related to overall aquifer water quality. Hartman and Lindsey (1993) comment that high chromium values may be a result of the stainless steel used for the well casing and screen. The potential for deep contamination will be further evaluated as part of the interim action.

Reference: Hartman, M.J., and K.A. Lindsey, 1993, *Hydrogeology of the 100-N Area, Hanford Site, Washington*, WHC-SD-EN-EV-027, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Washington Department of Fish and Wildlife (WDFW) general comment

1. **Comment:** The 100-N Area has multiple contaminants of concern that must be addressed by the proposed remedial actions of the 100-NR-1/100-NR-2 Operable Units. The 100-NR-2 groundwater operable unit affects the shoreline site of the 100-NR-1 operable unit. Proposed interim actions should not foreclose final remedial actions, which address all contaminants of concern above maximum concentration levels.

   Response: The Tri Parties agree with the comment. The proposed interim action is to continue the existing pump and treat system, which will not preclude a final remedial action.

Washington Department of Fish and Wildlife (WDFW) Specific Comments

1. **Comment:** WDFW concurs with the interim remedial actions for the 100 NR-1 sites.

   Response: Comment accepted.

2. **Comment:** WDFW concurs with the interim remedial action of the Sr-90 pump and treat while an evaluation of the effects of tritium, Sr-90, and hexavalent chromium on aquatic receptors is performed. The pump and treat establishes a hydraulic gradient preventing the other contaminants of concern from reaching the river. Furthermore, the effectiveness of the interim remedial action should be evaluated.

   Response: Comment accepted. The interim remedial action will be evaluated formally at the end of the first five years of operation under the interim record of decision.

Informal evaluation of the system will occur throughout its operation and at each yearly budget review cycle.

3. **Comment:** WDFW strongly agrees with the tri-party agencies that "more information must be obtained to determine whether Sr-90 concentrations are causing short- or long-term impacts to these [aquatic] receptors" and that "further evaluation of potential impacts to aquatic and riparian resources is considered a vital part of the proposed interim action". The contaminated groundwater is an exposure pathway to aquatic receptors, and aquatic receptors are currently exposed to contaminants of concern. WDFW requests studies be initiated to evaluate the impacts to aquatic receptors. We are dismayed that studies have not already been initiated.

   Response: Comment accepted. Discussions being held by the Tri-Parties and interested stakeholders under the Innovative Technology Remediation Demonstration project have included the proposal to further evaluate the impacts of the N Area groundwater on the ecological receptors in the area. It is expected that these discussions will lead to field sampling and subsequent impact analysis.

4. **Comment:** Terrestrial cleanup is occurring in the 100 Area. As part of the cleanup effort in the 100-N area, WDFW urges USDOE to initiate a moderate level biological evaluation of contaminants to terrestrial and avian species, and cooperatively work with WDFW, U.S. Fish and Wildlife Service and the Hanford Natural Resource Trustee Council in developing the biological studies. WDFW also would encourage the evaluation be expanded to include the entire 100 Area National Priority List site.

   Response: Ecology, EPA, and USDOE are also members of the Hanford Natural Resource Trustee Council and expect to work cooperatively with WDFW and others in developing a plan to access impacts of the remedial actions on terrestrial receptors in the 100 Area.

5. **Comment:** WDFW has not been provided adequate information to enable us to make any recommendations toward a final remedy for the 100 NR-2 operable unit and the shoreline site of the 100-NR-1 operable unit.

   Response: This is an interim action aimed at making substantial progress in an area of substantial contamination. The Tri-Parties are not currently in a position to issue a recommendation on a final action.

6. **Comment:** WDFW would like to point out to USDOE project staff that USDOE is a trustee and has responsibilities to the public concerning natural resources. The documents include I&I language identifying commitment of resources for each alternative response action. We believe such commitments are appropriate only after full mitigation, including compensatory mitigation, has been provided. It should be clearly stated that the intent of the I&I statements are being included as important public information, not as an attempt to circumvent natural resource damage liability.

Response: The language included in the documents speaks to the commitment of resources such as diesel fuel, backfill, and expendable equipment. The intent was to provide relevant information, as it became available.

7. **Comment:** The Corrective Measures Study is deficient due to a lack of environmental analysis, and as such, it is premature to consider final remedial alternative(s) and/or corrective action(s). Studies need to be initiated to evaluate impacts from tritium, Sr-90, and hexavalent chromium to aquatic receptors.

   Response: The Corrective Measures Study is sufficient to support the interim actions proposed.

General Comment by an Individual

1. **Comment:** Of the two alternatives I prefer alternative support, not remedial.

   Response: It is assumed that the commentor misunderstood the range of alternatives evaluated and the alternative recommended for implementation. Alternative support was not evaluated as part of this study, nor was a specific alternative called out as remedial.

Washington State Department of Health (DOH) General Comments

1. **Comment:** We are pleased that work is starting on this unit because we believe that 100-N is currently the main area of the Hanford Site where the public can receive radiation exposure from Hanford pollutants. The evaluation of the cleanup levels based on various land uses and controls coincides with the approach that DOH has recommended in its Hanford Guidance for Radiological Cleanup. DOH hopes that remediation of this area can proceed on schedule and using a sound technical basis that will give priority to those areas that have a current measurable dose impact on the public.

   Response: Comment accepted. The Tri-Parties have agreed to proceed with the remediation of the N Area using the schedule included with the corrective measures study.

DOH Specific Comments

1. **Comment:** The rural residential scenario used to evaluate future potential risks is sometimes referred as an unrestricted use scenario (for example, DOE/RL-97-30, page 13). This scenario also is implied to not preclude any future land use (for example, DOE/RL-96-102, page 4). Since this scenario restricts the use of 100-N Area groundwater, terms other than 'unrestricted use' or 'not precluding any future land use' would be more appropriate when referring to this scenario.

   Response: The term rural residential scenario is defined in DOE/RL-97-30, page 3, paragraph 4 and in DOE/RL-96-102, page 3, paragraph 8 as a scenario which includes restrictions on groundwater use, including a follow-on statement that drinking and irrigation water would need to be supplied from an offsite source (additional details of the scenarios are provided in Appendix F of the CMS.)

2. **Comment:** Reference is made to a 15 mrem/y dose standard for cleanup of sites contaminated with radioactivity. This cleanup level is sometimes referred to as an EPA standard, other times as an EPA draft standard, and other times as EPA guidance. For members of the public not familiar with radiation regulations, use of the term 'EPA standard' implies an EPA regulation with legally binding requirements. Since this EPA cleanup level has not been promulgated and has been withdrawn from consideration for promulgation, it would be more appropriate to consistently refer to it as EPA guidance.

   Response: Comment accepted. Consistently referring to the 15mrem/y dose standard for cleanup as an EPA guidance would be appropriate. This guidance is included under the category of 'to be considered' in the regulatory applicability section of the corrective measures studies and proposed plans and will be used to define the interim cleanup standards applicable to the proposed actions.

3. **Comment:** DOE/RL-96-102, page 19, Receptor Pathway Descriptions
   The text states that 'access control by the DOE currently prevents potential exposure to contaminated groundwater emanating at 100-N-Springs'. This is not the case at times of very low river stage, where ample dry land is exposed above the water line but below the marked radiation zones. This land is below the river's high water mark and is accessible to humans.

   Response: Warning signs at the N-Springs, which face the river, are intended to inform the potential trespasser of the dangers in the area. In addition, the Hanford Patrol and remediation personnel are in the area and are keenly aware of the contamination present at N Springs and the need to prevent intruder access.

4. **Comment:** The documents discuss cases where radiological contaminants either exist or may exist at concentrations above cleanup standards at depths greater than 4.6 meters below grade (for example, DOE/RL-97-30, page 8, and DOE/RL-96-102, page 12). Are these cleanup standards the soil concentrations corresponding to 15 mrem/y from contaminants in the first 4.6 meters below grade, for example those listed in Table 3, page 12 of DOE/RL-97-30?

   Response: The cleanup standards for these actions will be applied from current grade to 4.6 meters below grade. As described on page 16 of DOE/RL-97-30 and page 12 of DOE/RL-96-102 for those sites which have residual contamination above the cleanup standards at a depth greater than 4.6 meters several factors will be considered to determine the extent of additional remediation. These factors include reduction of risk by decay of short-lived radionuclides, protection of human health and the environment, remediation costs, size of ERDF, worker safety, presence of ecological and cultural resources, the use of institutional controls, and long-term monitoring. The cleanup standards are listed in Table 3, page 12 of DOE/RL-97-30 and in Table 2, page 9 of DOE/RL-96-102. The constituent concentrations listed in both tables represent an individual contaminate level equivalent to 15 mrem/y and would therefore result in a more restrictive cleanup concentration when more than one constituent is present at a waste site

5. **Comment:** Exactly how contaminants at depth are dealt with, and how they correspond to the depths of concern for the two exposure scenarios (4.6m for rural residential and 3m for ranger/industrial), is not clear. For example, the discussion in the CMS for the 116-N-1 Trench (DOE/RL-96-39) indicates remediation to 21 feet (6.4m) below grade, or 5 feet below the bottom of the engineered structure (located 16 feet below grade) for both exposure scenarios. The document did not make it clear why remediation to this depth was needed to meet the dose criterion for these scenarios, particularly for the ranger/industrial scenario.

   Response: The background information for the excavation depth to five feet below the normally required depth of 4.6 meters for these sites can be found in DOE/RL-96-39, page 4-6, Section 4.5. This section, entitled, Area of Contamination for Radiological Sites, refers to the Limited Field Investigation (DOE/RL 1996b), which documents the results of boreholes drilled along side and through the 1301 crib and trench and the 1325 crib. The samples collected from this event indicate a concentrated layer of radionuclides including plutonium-239-240, approximately 3-5 feet thick at a depth of 20 feet below surrounding grade. The Tri-Parties have agreed that this layer of concentrated soil could not be left behind and would therefore be part of the planned excavation.

<u>Comments by an Individual</u>

1. **Comment:** The use of an interim action containing 15 mrem/y does not accomplish MTCA cleanup by 2011 as promised by the Tri-Parties.

   Response: The Tri-Party commitment to complete cleanup in the 100 Area is documented in Milestone M-16 of the Tri-Party Agreement. It is anticipated that the milestone completion date of 2018 will be achieved using the agreed upon path forward.

2. **Comment:** 15 mrem/y is inconsistent with MTCA's 1 x 10-5 cumulative risk level for carcinogens.

   Response: The Tri-Parties believe that the 15 mrem/yr standard is appropriate and protective. The RESRAD model used to evaluate compliance with the standard looks comprehensively at exposure pathways, including the potentially significant dose resulting from external radiation. MTCA cannot calculate cleanup levels for external radiation dose, it was never set up to calculate radiochemical risk. Because of the modeling differences, for many radionuclides the 15 mrem/yr RESRAD standard is actually more stringent than the cleanup levels derived using MTCA methodology.

   EPA has determined, on a nationwide basis, that a 15 mrem/yr cleanup standard is considered protective. The NRC has established a standard of 25 mrem/yr and meet "as low as reasonably achievable" levels for unrestricted release following decontamination of licensed facilities. It is anticipated that the Washington Department of Health will propose regulations consistent with the NRC limits within the next few months. The Tri-Parties have consistently selected the lower 15 mrem/yr limit as the appropriate cleanup standard for Hanford.

Cleanup levels below 15 mrem/yr present substantial technical difficulties. In many cases, existing measurement methods cannot accurately measure less than 15 mrem above background. Requiring a more stringent cleanup level, unprecedented elsewhere in the DOE complex or in the international community, would significantly increase excavation costs and the areal footprint of ERDF.

3. **Comment:** The N documents recommend a rural residential cleanup scenario while a native subsistence scenario is more likely.

Response: The Tri-Parties issued the Interim Action Record of Decision for the 100-BC, DR, and HR operable units using the rural residential land use scenario so as not to preclude future land uses as may be determined by the appropriate agencies. The agencies responsible for land use determination have yet to make such a determination on the Hanford site. Therefore, the rural residential scenario being applied at 100-N is consistent with previous actions in absence of other determinations. The Tri-Parties will continue to engage in dialogue with stakeholders concerning the Native American subsistence scenario and other scenarios which may be applicable to the Hanford site cleanup evaluations.